

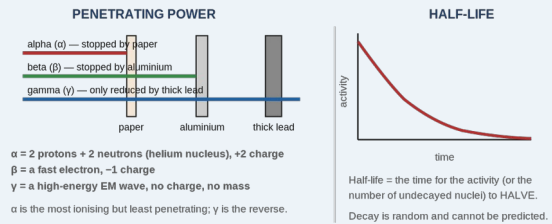
7.1 Radioactivity

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1. KEY VOCABULARY

TERM	MEANING
Isotope	Atoms of an element with the same protons, different neutrons.
Radioactive	Having an unstable nucleus that decays, emitting radiation.
Ionising	Radiation that knocks electrons off atoms — can damage cells.
Half-life	The time for the activity (or undecayed nuclei) to halve.
Background radiation	The low-level radiation around us all the time.

2. TYPES OF RADIATION & HALF-LIFE



3. THE THREE TYPES

TYPE	WHAT IT IS	STOPPED BY
Alpha (α)	Helium nucleus, +2	Paper / skin
Beta (β)	Fast electron, -1	Aluminium (few mm)
Gamma (γ)	High-energy EM wave	Thick lead / concrete

4. IONISING vs PENETRATING

Alpha: most ionising, least penetrating.
Gamma: least ionising, most penetrating.
 Beta is in between. The more ionising the radiation, the more damage it does to cells if it gets inside the body.

5. HALF-LIFE & SAFETY

Half-life: after each half-life the activity halves — but it is random, so you cannot predict any single nucleus.
Handling safely: keep your distance, limit exposure time, use shielding, and handle sources with tongs.

6. THE WHY

Why some nuclei are radioactive: their nucleus is unstable — it decays, emitting radiation, to become more stable.
Why alpha is dangerous inside the body but not outside: it cannot pass through skin, but if swallowed or inhaled its strong ionising power damages cells directly.

7. COMMON EXAM MISTAKES

- ✗ "Gamma radiation is the most dangerous in every case."
- ✓ It depends — alpha is far more harmful once inside the body.
- ✗ "You can predict when a nucleus will decay."
- ✓ Decay is completely random.
- ✗ "After two half-lives the activity is zero."
- ✓ It halves each time — after two half-lives it is a quarter.

8. SELF-CHECK · cover & quiz

- Can you...
- Describe the nature and charge of α , β and γ radiation?
 - State what stops each type?
 - Define half-life?
 - Work out the activity after a given number of half-lives?
 - State how to handle radioactive sources safely?
 - Explain why alpha is most dangerous inside the body?