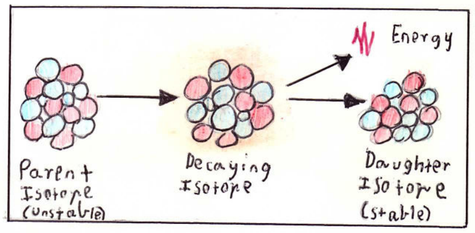
Radioactivity Revealed

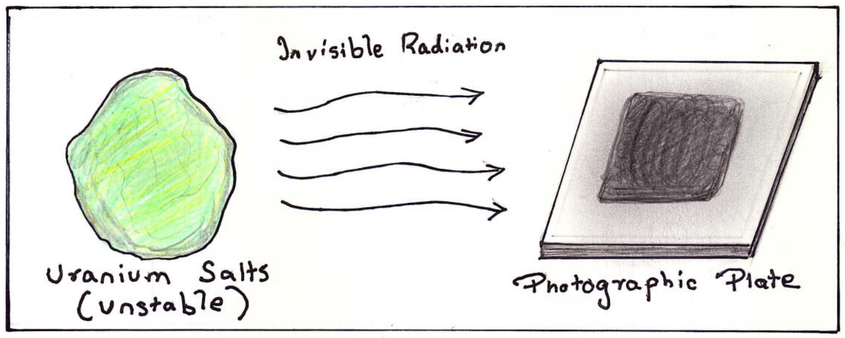
Radioactivity: A Natural Emission of Energy from Matter

Radioactivity occurs when unstable atoms release energy to become stable. This process can transform elements into new ones.



Accidental Discovery of Radioactivity (1896):

In 1896, Henri Becquerel, while studying X-ray discovered by Wilhelm Röntgen, investigated whether phosphorescent materials could emit X-ray when exposed to sunlight. On a cloudy day, he stored uranium salts with a photographic plate in a drawer. Later, he found the plate had darkened despite no light exposure. He concluded that uranium emits invisible energy from within itself, leading to the discovery of radioactivity, and this discovery shaped the world for centuries to come.

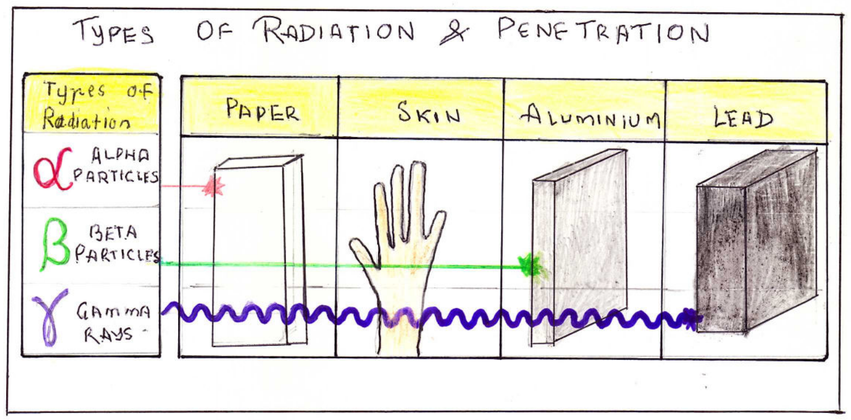


Inside the Atom: Understanding Radioactivity:

Marie Curie named the phenomenon "radioactivity", from radius (ray) and active, describing how unstable atomic nuclei release energy.

Types of Radiation:

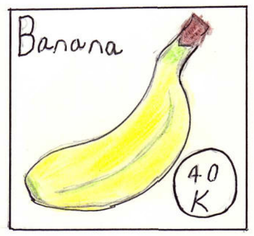
- **Alpha:** Low penetration; dangerous if inside the body
- **Beta:** Moderate penetration; harmful with prolonged exposure
- **Gamma:** Highly penetrating energy; requires thick shielding



Radiation is everywhere

Radiation isn't just found in unstable elements. It naturally surrounds us and is even part of our bodies.

- **Cosmic radiation** comes from the Sun, stars, and distant space, constantly reaching Earth.
- **Food** such as bananas, potatoes, and beans contains small amounts of radioactive potassium (Potassium-40).



👉 **These sources expose us to very low levels of radiation, which are completely normal and harmless in everyday life.**

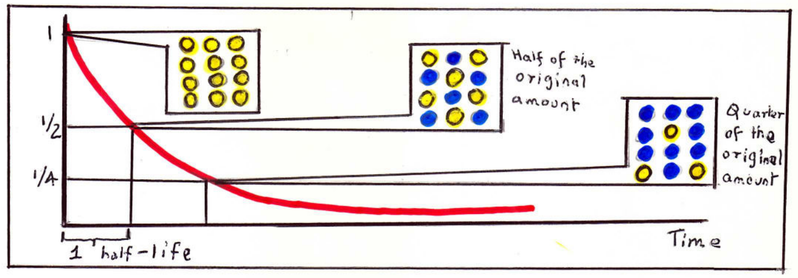
Half-life: The Clock of Decay

Half-life is the time it takes for **half of a radioactive substance to decay** into a stable form.

Each element has a fixed half-life, meaning it decays at a **predictable rate**. After every half-life, the amount remaining is halved (e.g., 100% → 50% → 25%).

- **Carbon-14 (~5700 years):** used to date fossils
- **Uranium-238 (~4.5 billion years):** used to date rocks and Earth

👉 **By measuring how much remains, scientists can estimate the age of materials.**



The Dark Side of Radiation:

In the early 1900s, luminous watches glowed using radium-based paint, prized for its ability to shine continuously in the dark.

To paint fine details, factory workers, mostly women, were instructed to sharpen the points of their brushes with their lips, unknowingly ingesting small amounts of radium over time. Prolonged exposure led to severe radiation poisoning, bone damage, and cancers, and many workers died.

👉 **This tragic event exposed the dangers of radioactive materials and led to major reforms in workplace safety and radiation protection laws.**

Healing with Radiation:

Radiation, while potentially harmful, plays a **vital role in modern medicine**.

- **PET scans (Positron Emission Tomography)** use a radioactive sugar (fluorodeoxyglucose) that is absorbed more by active cells. Cancer cells take up more of this substance, appearing as bright "hotspots" and helping detect disease.
- **X-ray (Radiography)** pass radiation through the body. Dense parts like bones block more radiation, creating clear images that help identify fractures and injuries.
- **Radiotherapy** treats cancer by directing focused X-ray or gamma radiations at tumours, damaging their DNA and killing cancer cells while minimising harm to surrounding healthy tissue.

👉 **From diagnosis to treatment, radiation is a powerful tool that helps doctors save lives every day.**

Radiation: Powering the Future:

Radiation is not only useful in science and medicine—it is also essential in modern technology and daily life.

- Smoke detectors use radioactive Americium-241 to detect smoke and save lives.
- Food irradiation kills bacteria, helping food stay safe and last longer.
- In industry, radiation is used to detect cracks and leaks in structures and pipelines.
- In space exploration, radioisotopes power spacecraft on deep-space missions.
- Nuclear energy uses radioactive materials to generate large amounts of electricity with no greenhouse emissions.

👉 **From homes to space, radiation is a powerful tool shaping a safer and more advanced future.**

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