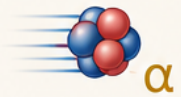
U-Rocks

Uranium Specimens & Scientific Samples

NATURAL RADIOACTIVITY

Radioactivity is the natural process by which unstable atomic nuclei release energy in the form of radiation. The three main types of radiation from natural radioactive decay are alpha, beta, and gamma.



Alpha (α)

Alpha particles are made of 2 protons and 2 neutrons (a helium nucleus). They are heavy, move slowly, and carry a +2 charge.

- Low penetration
- Stopped by paper or skin

Beta (β)

Beta particles are fast-moving electrons (β–) or positrons (β+) emitted from the nucleus. They are light and carry a −1 or +1 charge.

- Medium penetration
- Stopped by a few mm of aluminum

Gamma (γ)

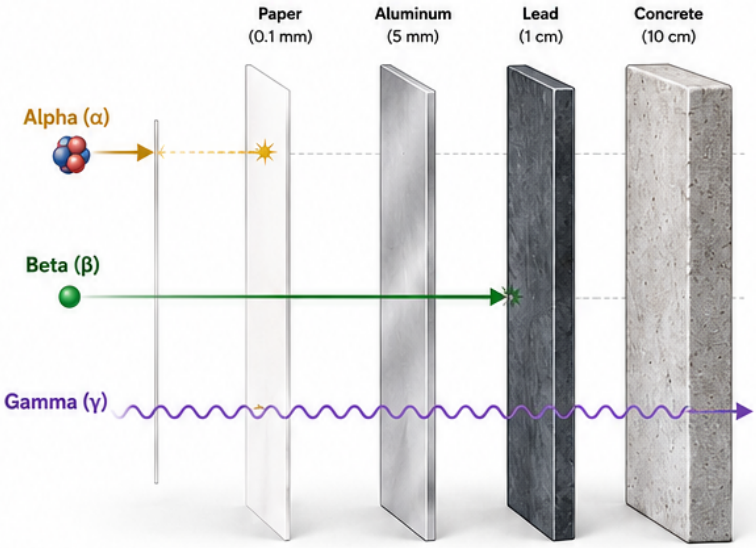
Gamma rays are high-energy electromagnetic waves emitted from the nucleus. They have no mass and no charge.

- Very high penetration
- Requires dense shielding (lead, concrete)

SAFETY NOTE: While natural radioactivity is generally low, it's important to handle radioactive materials with care, use appropriate shielding, and follow safety guidelines.

PENETRATION POWER

The ability of radiation to pass through different materials.



WHAT THIS MEANS

- Alpha radiation is easily stopped and poses little external threat but can be dangerous if inhaled or ingested.
- Beta radiation can penetrate skin and requires light shielding.
- Gamma radiation is the most penetrating and requires heavy shielding to reduce exposure.

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ADDITIONAL RADIATION TYPES

X-RAYS (X)

X-rays are electromagnetic waves like gamma rays, but are produced outside the nucleus when high-energy electrons interact with atoms (e.g., in X-ray tubes or during electron transitions).

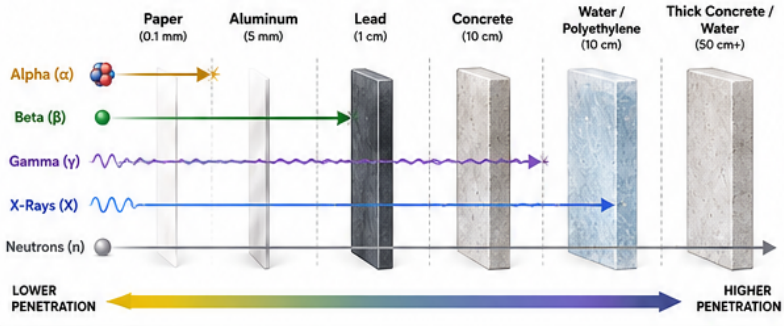
- No mass, no charge
- Medium to very high penetration
- Used in medical imaging, industrial radiography, and XRF (X-ray fluorescence) analysis

NEUTRONS (n)

Neutrons are neutral particles found in the nucleus. They are released during nuclear reactions such as fission, spontaneous fission, or (α,n) reactions.

- No charge
- Extremely high penetration
- Requires thick shielding (concrete, water, lead) or materials rich in hydrogen (water, polyethylene)

PENETRATION COMPARISON (EXTENDED)



DETECTION EQUIPMENT

Geiger-Müller (GM) Tube
Detects alpha (low efficiency), beta, and gamma radiation. Common for general survey meters.

Scintillation Detector
Detects gamma rays and X-rays with high efficiency. Used in spectroscopy.

Neutron Detector
Uses helium-3, BF_3, or plastic scintillators to detect neutrons.

Dosimeter
Measures accumulated radiation dose from all types.

SOURCES OF NATURAL RADIATION

Rocks & Soil
(Uranium, Thorium, Potassium-40)

Cosmic Rays
(from space)

Radon Gas
(in air, water, and soil)

Water & Food
(Trace amounts of radionuclides)

Our Bodies
(Potassium-40 inside us)

SHIELDING GUIDE (GENERAL)

Paper: Stops alpha

Aluminum: Stops beta

Lead: Stops gamma and X-rays

Concrete / Water / Polyethylene: Best for neutrons