



Nuclear Fission and Fusion: Splitting and Joining Atoms

KS4 PHYSICS

NUCLEAR REACTIONS

ENERGY

Ages 11-16 ⌚ 3 min read

What Are Atoms?

Everything in the world is made of tiny particles called **atoms**. At the centre of each atom is a nucleus, which contains even tinier particles called **protons** and **neutrons**. Electrons orbit around the nucleus like planets around the Sun. These particles stick together using enormous amounts of energy.

Nuclear Fission: Atoms Splitting Apart

Nuclear fission happens when a heavy atom, like **uranium**, breaks into two smaller pieces. When scientists fire a tiny neutron at a uranium nucleus, it splits violently and releases huge amounts of energy. This split creates more neutrons, which crash into other uranium atoms, causing a **chain reaction** that releases massive energy in seconds.

Think of it like: Dominos falling in a line. One domino falls and knocks over the next, which knocks over the next, creating a cascade that spreads quickly across the whole set.

This is how **nuclear power stations** generate electricity for our homes. The heat from fission boils water to create steam, which spins turbines that make electricity. However, fission also creates dangerous radioactive waste that must be stored safely for hundreds of years.

Nuclear Fusion: Atoms Joining Together

Nuclear fusion does the opposite of fission. Instead of splitting atoms apart, fusion forces two light atoms—usually **hydrogen**—to smash together at incredible temperatures and pressures. When they fuse, they create a heavier atom and release enormous energy.

Think of it like: Squeezing two marshmallows together so hard they merge into one bigger marshmallow and release heat and light.

Fusion happens naturally in **stars**, including our **Sun**. The Sun fuses **600 million tonnes** of hydrogen every second, releasing the light and heat that makes life on Earth possible. Scientists are trying to create controlled fusion on Earth to produce clean energy, but it's extremely difficult because you need temperatures hotter than the centre of the Sun.

Fission vs Fusion

Both reactions release incredible amounts of energy from tiny amounts of matter. Fission is currently used in power stations but creates radioactive waste. Fusion produces no dangerous waste and powers the universe, but we haven't mastered controlling it yet. Many scientists believe fusion will be the clean energy source of the future.