How Transformers Change Electricity Voltage

KS4 PHYSICS ELECTRICITY AND MAGNETISM Ages 11-16 ⏰ 3 min read

What is a Transformer?

A **transformer** is a clever device that changes the **voltage** of electricity. **Voltage** is the strength or pressure of electrical current — think of it like the force pushing water through a pipe. Transformers are found everywhere: on telephone poles, in phone chargers, and inside power stations. They're essential for getting electricity from power plants to our homes safely and efficiently.

How Do Transformers Work?

Transformers use two key ideas: **electromagnetic induction** and **magnetic fields**. Inside a transformer are two coils of wire wrapped around an **iron core**. When alternating current (AC) electricity flows through the first coil, called the **primary coil**, it creates a changing **magnetic field**. This magnetic field passes through the iron core and triggers an electrical current in the second coil, the **secondary coil**. The clever part? The number of loops in each coil determines whether the voltage goes up or down.

Think of it like a water wheel. If you have a small wheel connected by gears to a bigger wheel, the bigger wheel spins slower but with more force. A transformer with more loops in the secondary coil works the same way — it produces lower voltage but higher current.

Step-Up and Step-Down Transformers

There are two main types. A **step-up transformer** increases voltage using more loops in the secondary coil than the primary coil. This is useful for sending electricity across long distances — higher voltage means less energy is wasted as heat in the cables. A **step-down transformer** has fewer loops in the secondary coil, reducing voltage. This is what's in your phone charger, converting high-voltage wall electricity into the safe **low voltage** your phone needs.

Think of it like a recipe. More loops in the coil is like adding more ingredients — it changes what comes out the other end.

Why This Matters

Without transformers, we couldn't efficiently deliver electricity across countries. Power stations generate electricity at moderate voltages, then step-up transformers increase it for long-distance travel. When the electricity reaches towns and cities, step-down transformers reduce it to safe levels for homes and schools. This system saves billions of pounds and ensures our electrical grid works reliably every single day.