Why Some Materials Stretch and Others Break

KS4 PHYSICS Ages 11-14 ⏰ 3 min read

What Happens When You Pull Something?

Every material around you is made of tiny **atoms** stuck together like microscopic building blocks. When you pull, twist, or squeeze a material, you're actually moving those atoms apart or pushing them closer together. The way atoms behave when stressed is what decides whether something stretches, bounces back, or snaps.

Elastic Materials: The Bouncers

Some materials, like **rubber** and **springs**, are **elastic**. This means they can stretch or compress but return to their original shape when you stop pulling or pushing. Inside these materials, the atoms are held together loosely enough that they can move apart temporarily, but the bonds between them are strong enough to pull them back together.

Think of it like a game of tug-of-war where the rope stretches when you pull but snaps back to its original length when everyone lets go.

When you stretch a rubber band, the atoms inside move apart. Once you release it, the **bonds** between atoms pull them back into their normal positions. This can happen many times before the material gets tired.

Brittle Materials: The Breakers

Other materials, like **glass**, **ceramics**, and **concrete**, are **brittle**. These materials don't stretch much at all—when the stress becomes too great, they suddenly snap or shatter into pieces. The atoms in brittle materials are held in a rigid structure that doesn't like to bend or flex.

Think of it like a piece of chalk: it won't stretch when you pull it, and if you bend it even slightly, it breaks into two pieces.

The Strength and Limit of Materials

Every material has a **breaking point**—a level of stress that it simply cannot handle. Scientists measure how much force a material can take before it deforms or breaks. **Steel** is very strong and can handle enormous forces before breaking, while materials like **ceramic** can only handle forces in certain directions.

The difference comes down to how the atoms are arranged and bonded. In stretchy materials, atoms can slide past each other slightly and return to place. In brittle materials, atoms are locked in place and shatter rather than slide.

Plastic Deformation: The Point of No Return

Between pure elasticity and breaking, there's something called **plastic deformation**. If you bend a metal paperclip back and forth, it eventually stays bent. The atoms have moved to new positions and won't return, even though the material didn't break. This is plastic deformation—the material has permanently changed shape.

Understanding why materials behave differently helps engineers choose the right material for each job: rubber for shock absorption, steel for bridges, and glass for windows.