How does 3D printing work?

KS2 KS3 Ages 7-14 ⏰ 3 min read

Factories have traditionally made things by cutting, moulding, or stamping materials into shape. 3D printing does the opposite — instead of starting with a big block and removing material, it builds objects up from nothing, adding material layer by layer. It sounds futuristic, but the technology has been around for decades and is now cheap enough to buy for home use.

Start with a digital design

Every 3D-printed object begins life as a digital 3D model — basically a detailed computer drawing that describes every surface and corner of an object. You can design these yourself using software, or download designs that other people have shared online. There are huge free libraries of 3D-printable files for everything from replacement toy parts to phone stands to miniature chess pieces.

Slicing the model

Before printing, special software called a **slicer** cuts the 3D model into hundreds or thousands of very thin horizontal slices — like a digital loaf of bread. Each slice becomes one layer that the printer will produce. The slicer works out exactly what shape each layer needs to be and sends the instructions to the printer.

Think of building a sandcastle layer by layer, adding one thin sheet of damp sand at a time, each slightly different shape, until the whole castle appears. That's exactly how a 3D printer thinks about the object it's making — as a stack of slices, not as a single whole thing.

How the printer actually builds

The most common type of 3D printer melts plastic — usually in the form of a long filament wound on a spool — and squeezes it through a heated nozzle. The nozzle moves precisely across a flat platform, tracing the shape of each slice. When it finishes one layer, the platform drops slightly and the nozzle traces the next layer on top. Slowly, layer by layer, the object grows upwards.

The whole process can take anywhere from 20 minutes (for something tiny and simple) to several days (for something large and detailed).

What can you print?

Consumer printers mostly use plastic, but industrial machines can print in metal, ceramic, resin, rubber, and even human tissue. Surgeons use 3D-printed models of patients' organs to plan complex operations. Aerospace companies print lightweight metal components. Architects print scale models of buildings. Some researchers are working on 3D-printing edible food and replacement bones.

The big limitation right now is that 3D printing is slow compared to mass production. For one-off objects, prototypes, or tricky custom shapes, it's brilliant. For making a million identical plastic spoons, a traditional factory wins every time.