



How is a star born?

KS2

KS3

Ages 7-14 ⌚ 3 min read

Between the stars, space isn't empty. It's filled with thin clouds of gas (mostly hydrogen and helium) and dust — called **nebulae**. These clouds are the nurseries where stars are born.

Step 1: Collapse

When a region of a gas cloud is dense enough (or disturbed by something like a nearby supernova shockwave), gravity takes over. The gas begins to fall inward, pulling more material with it. As the cloud collapses, it heats up — just as air in a bicycle pump heats up when compressed. The centre grows hotter and denser. At this stage, it's called a **protostar**.

Squeeze a foam ball hard enough and the foam in the middle gets compressed and warm. Now scale that up to a cloud of hydrogen thousands of times the size of the Solar System, collapsing under gravity over millions of years. The centre gets so compressed and so hot that something extraordinary happens — a threshold is crossed and nuclear reactions begin. The ball of gas starts generating its own energy. That's the birth of a star.

Step 2: Nuclear ignition

When the core temperature reaches about 10 million degrees Celsius, hydrogen nuclei are moving fast enough to overcome their mutual repulsion and fuse together. **Nuclear fusion** begins — hydrogen fusing into helium, releasing enormous amounts of energy. The energy pushes outward, balancing gravity pulling inward. This equilibrium is a **main sequence star** — stable, steady, shining. Our Sun has been in this phase for 4.6 billion years and will continue for about another 5 billion.

Does a star's mass matter?

Enormously. Massive stars burn their fuel far faster — a star 10 times the mass of the Sun might live only 10-20 million years, compared to the Sun's 10 billion. The most massive stars burn so intensely they exhaust their fuel in just millions of years. They also die more dramatically: rather than gently puffing off their outer layers like the

Sun will, massive stars end in supernovae — explosions visible across entire galaxies — and often leave behind a neutron star or black hole.