

Lesson 4: Gravity

Right now, even as you sit perfectly still, a force is acting on every cell of your body. It is pressing you gently into your seat. It is holding the sky in place above you. It is pulling rain down from clouds and rivers down to the sea. It is keeping the Moon swinging around Earth and Earth sweeping around the Sun. This force is **gravity**, and it may be the single most important force in the history of the universe.

Gravity is a pull that exists between everything that has **mass**, and everything in the universe has mass. The greater the mass of an object, the stronger its gravitational pull. The Sun is so massive that its gravity reaches all the way to the outer edges of the solar system, holding every planet in its **orbit**. Earth is massive enough to hold its oceans, its atmosphere, and all of us firmly on its surface. Even you pull on everything around you, though your pull is so small compared to Earth's that you never notice it.

Isaac Newton was among the first to understand gravity mathematically. The famous story says an apple fell from a tree near him and he began to wonder: why does everything fall *down*? Why not up or sideways? His answer, that every object in the universe attracts every other object, transformed science. Later, Albert Einstein revealed something even stranger: gravity is not really a force at all. It is a curve in the fabric of space itself, the way a heavy ball makes a dent in a stretched rubber sheet, and everything nearby rolls toward it.

For life on Earth, gravity is not just essential. It is also irreplaceable. It pulled the planet together from dust and rock billions of years ago. It keeps the atmosphere wrapped around us so we have air to breathe and water in the oceans rather than floating away into space. **Weight** is the force you feel when you stand on a scale: it is gravity pulling on your mass. Every raindrop that reaches a root, every river that reaches the sea, every seed that falls into soil, all of it happens because of gravity. Without gravity, there is no Earth. Without Earth, there is no life.