HOME DEMO NO. 27

On The Space Shuttle You Can Eat All You Want, and Still Weigh Nothing

The Earth is so big, it has a lot of gravity, and keeps us all planted on its surface. Since the Sun is gigantic compared to the Earth, it has even more gravity. The Sun's gravity is what keeps our Moon and all the planets in orbit, even far-off Pluto, some 6 billion kilometers (3.5 billion miles) away. Gravity is powerful. But when astronauts go up in the Space Shuttle, they orbit just 400 kilometers (250 miles) above the Earth, much closer than the Moon. They're pretty close, yet they start to float around. It's as though there's no gravity at all. How can this be?

Shuttle astronauts float weightlessly because they're falling. Flick a penny off a table, and it will still fall. But it lands some distance from the table edge. Objects in orbit, like astronauts and shuttles, are going so fast that they fall around the Earth. Things that are falling can't be weighed. If you went skydiving and you took a scale with you as you jumped out of the plane, the scale would read "0." Both you and the scale would be falling, so you couldn't press against it. It's the same with astronauts and their equipment.

See how it works with a Weightless Clothespin of Science!

What you need:

1. Two clothespins
2. One big, thick rubber band.

What you do:

1. Clip your clothespins onto opposite sides of the rubber band.
2. Hold up one of the clothespins. The weight of the other clothespin pulls down on the rubber band, making it into an oval or stretched shape.
3. Let go of the clothespin.

What's happening?

Gravity pulls the clothespins and rubber band toward the floor. But since they are falling together, the bottom clothespin will no longer seem heavy to the rubber band. To help keep a close eye on your experiment, get a friend to drop it from a high place or throw it into the air outside. If you watch carefully, you'll see that the rubber band stops being stretched by the weight of the clothespins. It goes back to its shape. The bottom clothespin does not pull down when it's falling. The whole rubber band/clothespin system is falling. It's weightless! Astronauts in the Space Shuttle float around for the same reason -- since they're falling, they have no weight!