

Reflect

Have you ever tried jumping up as high as you can? What happens when you jump into the air? Your feet and body are not touching the ground at first. What pulls you back down to the ground? You do not float and remain in space after you jump. That is because a force called gravity pulls you back down to Earth.

What is gravity?

Gravity is an invisible **force** that can move objects by pulling them toward each other. Gravity is actually what pulls objects toward the center of Earth. This is why when you sit in a chair, the chair is pulled down toward Earth. You are then pulled down toward Earth, too.

The Law of Gravity

Isaac Newton developed the law of gravity. It states that gravity is a force that pulls all matter together. Newton's law of gravity states that for any two objects in the entire universe, the gravity between these two objects depends on their **mass** and distance. Gravity gets weaker with distance. This explains why the gravity of the Sun does not pull us off Earth's surface. It is too far away.



The toddler is sliding down the slide due to gravity.

force: a push or pull

mass: the amount of matter contained in an object or substance



Gravity is very helpful to us.

We experience gravity on Earth every single day. When you are playing basketball, and you jump to shoot the ball, gravity is what pulls you back down to Earth. We are dependent on the force of gravity to hold everything down. It keeps things in their place on Earth, including people, trees, plants, bodies of water, animals, cars, and buildings. Gravity even contains the atmosphere in which we breathe. Without the force of gravity, life would cease to exist on Earth. Imagine what it would be like if gravity was not holding you and everything else down.

How can we overcome gravity?

Gravity can be overcome by using a greater force. In order to overcome gravity, an upward, pulling force exerted on an object must be greater than the downward, pushing force of gravity. The force on the object must be stronger than the gravitational pull of Earth.

Whenever an object is lifted or moved upward, gravity's resistance trying to push the object down toward Earth must be overcome. Think about when you lift or pick up any object. You must use enough **energy** to overcome its force of gravity, also known as **weight**. Try picking up a book off a desk. You are stronger than the force of gravity on the book. You just overcame gravity by lifting the book with more force!

Picking up a small object, such as a crayon or pencil, would require less force applied to it than the force it would take to lift a desk. Let's say that you were trying to lift a 10-pound dumbbell. It would take more than 10 pounds of an upward force to be able to lift it. This is because gravity is supplying a downward force of 10 pounds.

Gravity can be overcome by using a greater force. Some examples are jet propulsion, a person throwing a ball, an electric elevator, or structures for support like buildings and stairs. Some more examples are:



energy: the ability to do work or cause a change

weight: a measure of the pull of gravity on an object



The jet engine works to propel this airplane through the sky. It helps the wings create a lift force to overcome gravity.

- The Space Shuttle: The force of the engine and the rocket boosters produce enough force to lift the shuttle off the ground.
- Airplanes: Gravity wants to pull the plane to the ground. However, the airplane is able to overcome the force of gravity through a force called lift. Lift is produced by the wings as they move forward through the air.
- Flying animals (birds, insects, bats, etc.): They are able to overcome gravity when they are working to flap their wings. That produces more lift than the force of gravity pulling them down.

What Do You Think?

Think about how we rely on gravity for everyday activities such as walking, running, riding a bike, and more. What do you think life on Earth would be like if there were no gravity? Using what you have learned above, write a story and draw pictures about what you think life would be like without any gravity to hold us down on Earth.

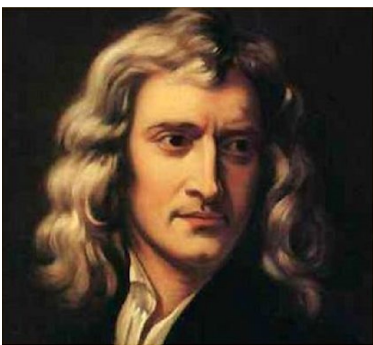


Look Out!

Gravity can be extremely helpful. It can also be harmful. The force of gravity can cause avalanches to happen suddenly. Avalanches are caused when the force of gravity overcomes the forces that are holding the snow in place. This snow is then projected down a mountain, slope, or cliff. It causes damage to homes and property, loss of habitat, or even death. Gravity can also cause landslides. They can erode (wear away) an area. A landslide is the movement of rock or debris down a slope, driven by gravity. Landslides can be just as harmful as avalanches.



Scientists in the Spotlight: Sir Isaac Newton



Sir Isaac Newton was a scientist, mathematician, astronomer, physicist, and philosopher. He is best known for defining the three laws of motion. These are known as Newton's laws. He is also known for his law of universal gravitation. He stated that gravity is the reason objects fall to the ground. According to a famous story, Newton developed this law of gravity from observing an apple fall from a tree in his garden.

Newton also developed calculus. He even developed the world's first reflecting telescope. We now call it the Newtonian telescope. This telescope was based on his theory of optics. Newton developed a theory of color. The theory stated that objects appear certain colors because they absorb and reflect different amounts of light. With all these accomplishments, it is no wonder that Albert Einstein called Newton the smartest man who ever lived.