

WOW sheet

What is gravity?

Here is what 'gravity' means in physical science:

Gravity is a special force that attracts matter to other matter.

In other words, gravity is a pulling force that attracts objects to other objects. The more **matter** something has, the greater the force of its gravity.

Matter is anything you can physically touch. You can think of matter as the physical 'stuff' a thing is made up of.

Gravity is a **non-contact force**. That means that objects do not have to touch each other for the force of gravity to affect them.

The force of gravity is often written as F_g . When we are talking about gravity on Earth, it is sometimes written as just g . The force on an object caused by gravity is also known as **weight**.

Gravity on Earth

On the planet Earth, gravity makes things accelerate down towards the ground. That's why it's easy to think of gravity as a force that makes things 'fall down'.

The truth is, gravity is more complex than that.

Remember, gravity actually pulls objects towards each other. This is why it is sometimes called **gravitational attraction** or **gravitation**

because objects, all objects, are pulled towards each other. So why does everything on Earth fall down?

Basically, it's because the Earth is so very, VERY big!

Here's an example

Did you know that you pull on the Earth just as much as it pulls on you? It's true! Newton's third law of motion tells us that when object X (in this case, the Earth) exerts a force on object Y (in this case, you), then object Y (you) exerts an equal and opposite force on object X (the Earth).

In other words, you are pulling the Earth up with just as much force as it is pulling you down!

So, why do you fall back down to earth if you jump rather than the ground rushing up to meet your feet?

That's explained by Newton's second law of motion, which tells us that same size force will cause an object with greater mass to accelerate less.

Because the Earth has so much mass, the acceleration you cause on the Earth isn't noticeable. But the acceleration that results from the Earth exerting that same size force on you? That you definitely notice!

Near the surface of the Earth, the local **gravitational acceleration** is 9.8 meters per second squared ($9.8 \frac{m}{s^2}$). In other words, everything on Earth is being accelerated towards the centre of the Earth at a rate of $9.8 \frac{m}{s^2}$.

Calculating gravity

Sir Isaac Newton formulated the Law of Universal Gravitation. Using this law, you can calculate the force of gravity between any two objects. This is also the equation that gives us the rate of gravitational acceleration on Earth as being $9.8 \frac{m}{s^2}$!

Formulaically, it can be written as:

$$F_g = G \frac{m_1 \times m_2}{r^2}$$

In this equation:

- (F_g) is the force of gravity,
- (G) is the gravitational constant (which is a really tiny number: $6.67408 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$),
- (m_1) is the mass of object 1,
- (m_2) is the mass of object 2, and
- (r) is the distance between the centre of mass of the two objects.

