BBC Bitesize – Physics

Episode 2 – Gravity

ELLIE: Hello and welcome to the BBC Bitesize Physics podcast.

JAMES: The series designed to help you tackle your GCSE in physics and combined science. I'm James Stewart, I'm a climate science expert and TV presenter.

ELLIE: And I'm Ellie Hurer, a bioscience PhD researcher.

ELLIE: We're covering lots of different aspects of forces in this series, so make sure to listen to the rest of the episodes too.

JAMES: Yeah, and they're really good. Okay, let's get started because today, I thought so, because today we're talking all about the force that keeps our feet on the ground, gravity.

ELLIE: While we often think about space and astronauts when we talk about gravity, gravity actually acts all around us every single day. Because the definition of gravity is a force of attraction between two objects.

JAMES: The gravitational field is the area around an object where another object will feel a force of gravitational attraction from it.

Gravitational field strength is measured in newtons per kilogram, written out as ‘n’ forward slash ‘kg’.

ELLIE: And the size of the gravitational field strength affects the force of gravity acting on an object in that gravitational field. The other thing that affects the size of gravity is the object's mass. The bigger the mass, the greater the force of gravity.

JAMES: So one key thing to know that a lot of people misunderstand is that weight and mass are actually two different things.

ELLIE: Yeah, so when we say, oh, this loaf of bread weighs 400 grams, we're actually saying that the mass of the loaf of bread is 400 grams.

JAMES: Because mass is about the amount of matter, whereas weight is a force and is the heaviness due to gravity.

ELLIE: Exactly. So let me tell you about the equation you need to calculate the force of weight of an object.

JAMES: Yeah, I'm gonna get my pen and paper out for this one, so if you're listening, please feel free to do the same thing and write along as we go through this.

ELLIE: So, weight equals mass multiplied by the gravitational field strength.

JAMES: Weight is measured in newtons. Mass is measured in kilograms and gravitational field strength is measured in newtons per kilogram.

ELLIE: So to calculate the weight of an object in newtons, you multiply its mass in kilograms by the strength of the gravitational field in newtons per kilogram.

JAMES: That was a lot. Don't panic. Let's just hear that again.

ELLIE: So weight equals mass multiplied by the gravitational field strength.

JAMES: Weight is measured in newtons, mass is measured in kilograms, and gravitational field strength is measured in newtons per kilogram.

ELLIE: So, to calculate the weight of an object in Newtons, you multiply its mass in kilograms by the strength of the gravitational field in Newtons per kilogram.

JAMES: Right, let's try out some examples then. And if you don't have your pen and paper just yet, now would be the perfect time to grab them and you can write down these calculations with us as we go along.

ELLIE: Let's say we want to find out the force of gravity, their weight, acting on your physics teacher as they stand at the front of the classroom.

JAMES: Good image. Now first, you would need to find out their mass. Now let's say it's 80 kilograms, then you need to know the gravitational field strength of the planet they're standing on, which for the planet of Earth is 9.8 newtons per kilogram.

ELLIE: So to measure the force of weight acting on them, you would write down their mass of 80 kilograms and then multiply it by the Earth's gravitational field strength of 9.8 newtons per kilogram to get the answer 784.

JAMES: And because weight is measured in newtons, their weight would be 784 newtons downward. We always have to include those units. And because weight is a force, which is a vector quantity (more about that in episode one), we also have to say the direction it is in, which in this case is downwards.

ELLIE: In those instances, the weight of an object and its mass are directly proportional. So let's say if something had a bigger mass, its weight would be higher. And if something had a smaller mass, its weight would be lower.

JAMES: Exactly. And when we're measuring weight in terms of gravity, we don't use regular kitchen scales. We use something called a newton meter, also known as a calibrated spring balance.

ELLIE: And when we do that, we say that the weight of an object, or in this case, person, acts at a single point. The object or person's centre of mass. The force of gravity, weight, always acts from the middle of an object, straight down.

JAMES: Okay, that was a lot, but I hope that helped you understand gravity a little bit more.

ELLIE: So, let's recap the three main points.

Firstly, gravity is a force of attraction between two objects. The next point is, mass is the amount of matter in an object. However, weight is the force of gravity acting from the middle of the object straight down.

And finally, the equation to find out an object's weight is mass multiplied by gravitational field strength equals weight.

ELLIE: There's your key points about gravity. In the next episode of Bitesize Physics, we're going to dig into work done and energy transfer, and I cannot wait.

JAMES: I believe you. Thank you for listening to BBC Physics. If you found this helpful, and hopefully you did, please do go back and listen, make some notes, so you can come back here and always have this as your point to revise from.

JAMES: Thank you, bye! Bye!