BBC Bitesize – Physics

Episode 6 – Acceleration

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.

JAMES: And what we're going to do is break down all those quite complicated looking equations. The great thing about this being a podcast, Ellie, is people can rewind it. I know when you do your PhD you like to write loads of notes.

ELLIE: You know, it can take time to understand these concepts, but trust in yourself and you will get there in the end.

JAMES: We're going to guide you through all of these, to help you ace that exam.

ELLIE: You've got this.

JAMES: Today we're gonna be talking about acceleration.

ELLIE: In the last episode, we talked about the fundamentals of distance and displacement, then speed and velocity. So if you haven't listened to that, be sure to go back as this episode will make a lot more sense after listening to the previous episode.

Okay, let's go back to the racetrack and begin.

JAMES: So, when we talk about acceleration, we're talking about the change in velocity of an object within a specific time. Acceleration is a vector quantity too. So when we talk about it, we talk about both magnitude and direction.

ELLIE: All right, if you haven't already, grab a pen and paper because it's time for the equation to calculate acceleration.

JAMES: Straight into the equations. Okay, acceleration equals change in velocity divided by time taken. Okay, now it's your turn to write your calculations out and work out the answer to this question.

If a car starts off driving at 10 metres per second north and then reaches 30 metres per second in 4 seconds, how would you calculate its acceleration?

ELLIE: First, you would calculate the change in velocity, which is the final velocity minus the initial velocity. In this case, that is 30 metres per second, minus 10 metres per second. So the change of velocity is 20 metres per second.

Next, you would calculate the acceleration, which equals that change in velocity of 20 metres per second, divided by the 4 seconds it takes. So, in this case, acceleration equals 5 metres per second squared north.

JAMES: Yeah, and you can also apply this equation to something slowing down as well. In which case you end up with a negative acceleration. Which is commonly known as a deceleration.

ELLIE: Right, but what if the race car is constantly accelerating? Like, if its speed changes by 10 metres per second in the first second, and then by 10 metres per second in the second second, and so on.

JAMES: Well then, in that case, it's called a uniform acceleration. When a moving object's speed changes at the same amount each second. If you wanted to calculate uniform acceleration, you could use a different equation.

The equation for uniform acceleration is: final velocity squared, minus initial velocity squared, equals two multiplied by acceleration, multiplied by distance.

ELLIE: Sorry to ask James, but can you repeat that?

JAMES: I knew you were gonna say that. Yes, of course for you.

The equation for uniform acceleration is: final velocity squared, minus initial velocity squared, equals two, multiplied by acceleration, multiplied by distance, and you'd see that written as V squared minus U squared equals two times by A times by S.

ELLIE: Wow, James, that deserves a round of applause.

JAMES: Oh yeah, you actually did as well, thank you.

ELLIE: Okay, so when we're near the surface of the Earth, all free falling objects have an acceleration of 9.8 metres per second squared. So, let's say I went skydiving,

I would fall at an acceleration of 9.8 metres per second squared. Now that sounds kind of scary.

JAMES: It does, yeah. Would you go skydiving?

ELLIE: No.

JAMES: That acceleration would cause you to speed up. As you speed up, the friction force from the air will increase until it's equal to your weight. That makes the resultant force on your body zero, so it no longer accelerates. Instead, you would travel at a constant velocity, which is known as terminal velocity. Which is exactly, handily, what we're going to cover in the next episode.

ELLIE: Ooh, okay, I love a cliff-hanger, James. But before we go, let me give you a quick recap of what we've learned today. Firstly, acceleration is a vector quantity. It's the change in velocity of an object in a given time. The formula to work it out is acceleration equals change in velocity, divided by time taken.

Next, we learned that any object free falling near the surface of the Earth has an acceleration of 9.8 metres per second squared. And finally, the equation for uniform acceleration is: final velocity squared, minus initial velocity squared, equals two multiplied by acceleration, multiplied by distance.

Okay, so now you know more about acceleration. In the next episode of Bitesize Physics, we're going to find out what a resultant force is and get into Newton's three laws

JAMES: We certainly shall. Thank you for listening to Bitesize Physics. If you found this helpful, you might need to go back for this one, listen to those equations, make some notes and then come back anytime you need to revise.

BOTH: Bye!