BBC Bitesize – Physics

Episode 3 – Work done and energy transfer

JAMES: Hello and welcome to the BBC Bitesize physics podcast.

ELLIE: The series designed to help you tackle your GCSE in physics and combined science.

JAMES: I'm James Stewart, I'm a climate expert and TV presenter.

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

JAMES: And just a quick reminder that whilst you're here in the BBC Sounds app, there's also the Bitesize Study Support podcast, which is jam packed full of tips to help you stay focused during revision and get the best out of your exam day.

ELLIE: Okay, let's get started. Today we're going to be talking about energy transfer and work done.

So one of the most important things you need to know about energy is that it's never created nor destroyed, it's just transferred through different objects and forms.

JAMES: So when you kick a football, or you push a suitcase, you use a force to move an object through a distance and displace it from one place to another, which is called work done.

ELLIE: If you've got a pen and paper, let me give you a simple definition to write down.

Work done is when a force causes an object to move through a distance. When a force transfers energy from one store to another.

JAMES: So when you kick a ball, you transfer energy from the chemical energy store in your muscles and your foot, to the kinetic energy store in the ball. Now remember that any moving object has a store of kinetic energy.

ELLIE: When you light a match, you transfer energy from the kinetic energy store in the moving match into the thermal and light energy stores of a fire. Thermal energy simply means heat.

JAMES: So as with a lot of the topics we've talked about so far, we need to use an equation, of course it's physics, to calculate work done. So if you don't already have it, again, good time to grab that pen and paper, and here we go.

ELLIE: So, the equation to calculate work done is: work done equals force multiplied by distance.

JAMES: Work done measures the transfer of energy. Force is measured in newtons and distance is measured in metres, which means work done is simply measured in newton metres.

ELLIE: But when we talk about work done, we measure it in joules. One newton metre is the same as one joule. So work done should be measured in joules. Or simply the letter ‘J’.

JAMES: In case you didn't get a chance to write that down, don't worry, I will repeat it again for you.

Force, measured in newtons, multiplied by distance, measured in metres, equals work done, measured in joules. There we go, it's simple when you sell it, isn't it? Let's say you push a shopping trolley down the aisle with the force of 2 newtons. And that pushes it along by a distance of 5 metres. How, Ellie, would you write that down as an equation?

ELLIE: So, let's write this out together. Okay, so, two newtons of force, multiplied by five metres of distance, equals ten joules of work done.

JAMES: Hey, perfect. And one other thing to know, is how energy is transferred when it comes to friction. Friction, of course, is the force that opposes motion.

Let's say it's your best mate's birthday party, and you want to strike a match, so you can light up the candles on their cake. You're a very good friend. So to do that, you use kinetic energy, movement, to swipe the match against the side of the matchbox.

ELLIE: And that kinetic energy creates friction.

Friction causes the temperature to rise on an object, and once that match has been swiped across, it lights a fire.

JAMES: This means that lighting the match transferred energy from the kinetic energy store into the thermal energy store through friction.

ELLIE: And that your best friend can finally blow out the candles and celebrate their birthday in style.

JAMES: They probably melted by the time I figured that equation out.

So I hope those explanations were super helpful. Let's recap the three main things that we learned. Number one, when a force causes an object to move through a distance, work is done on the object. Secondly, the equation to calculate work done is work done equals force multiplied by distance.

And finally, work done against the frictional forces acting on an object causes a rise in the temperature of the object, transferring kinetic energy into thermal energy.

ELLIE: Right. So those are some of the key facts about energy transfer and work done. In the next episode of this series, we're going to be talking all about forces and elasticity.

JAMES: Thank you for listening to Bitesize Physics. If you found this helpful, go back, listen again and make some notes so you can come back to this anytime you want and revise away.

BOTH: Bye!

JAMES: We did it in time that time!

ELLIE: I sort of watch you, and I'm like “Bye!”