Transferring energy by forces

It takes energy to power a car, make a plane fly, or ride a bike. The energy transferred when a force moves an object is called work.

Work done

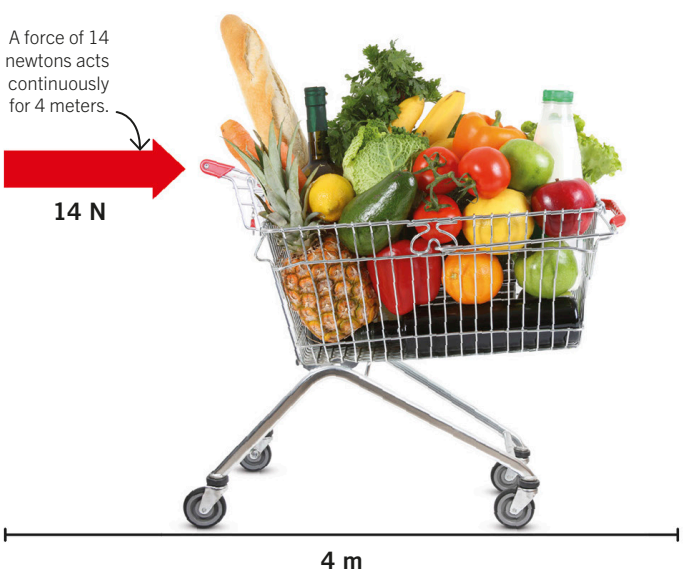
The scientific meaning of "work" is different from its everyday meaning. When you push an object, the force does work to move it and transfers energy from your body to the object's kinetic energy store. As work done is a measure of energy, the units are joules (J). You can work out the total energy transferred by multiplying the force by the distance moved in the direction of the force.

$$\text{work (J)} = \text{force (N)} \times \text{distance (m)}$$

$$W = F \times d$$

For instance, if you push a loaded shopping cart for 4 m with a continuous force of 14 N, you've done 56 J of work.

$$W = F \times d$$
$$= 14\ \text{N} \times 4\ \text{m}$$
$$= 56\ \text{J}$$

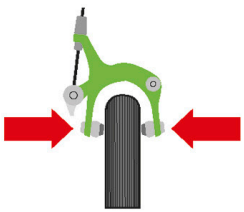


Key facts

- ✓ **The energy transferred when a force moves an object is called work.**
- ✓ **As work done is a measure of energy, the units are joules (J).**
- ✓ **Work done equals force multiplied by distance moved in the direction of the force.**

Examples of work

Work is done whenever energy is transferred.



When you pull the brakes on a bike, the force of friction between the brakes and wheel does negative work. Friction transfers energy from the bike's kinetic energy store to thermal energy, making the bike slow down.

When you drop a ball, the force of gravity does work and energy is transferred to the ball's kinetic energy store, making it accelerate.

When you stretch a spring, the force transfers energy to the spring's store of elastic potential energy. The force needed increases as the spring gets harder to stretch (see page 82).