

Newton's Three Laws of Motion

How forces start, stop and change motion, with an everyday example of each law.



1st law: inertia

With no resultant force, a still object stays still and a moving object keeps the same speed in a straight line.



In real life: seat belts

When a car brakes hard, your body keeps moving forwards. The seat belt supplies the force that slows you down.



2nd law: $F = ma$

Resultant force = mass $\times$ acceleration. A bigger force gives more acceleration; a bigger mass gives less.



In real life: a full trolley

Push a full shopping trolley and an empty one equally hard: the full one, with more mass, speeds up more slowly.



3rd law: interaction pairs

If A pushes or pulls on B, B pushes or pulls on A with a force of the same size and type, in the opposite direction.



In real life: a rocket launch

The rocket pushes exhaust gas down; the gas pushes the rocket up. The two forces act on different objects.



Worked example

A 1,200 kg car has a resultant force of 2,400 N. $a = F \div m = 2,400 \div 1,200 = 2 \text{ m/s}^2$. One newton gives 1 kg an acceleration of 1 m/s^2 .



Common mistake

Moving objects do not need a force to keep going. They slow down because friction and air resistance act on them. Third-law pairs never cancel out.