

Pushes, pulls and balanced forces

Grade 7 science (Year 8 · Class 7) · Lesson

Quick answer: A force is a push or a pull, measured in newtons with a spring scale. Forces act in equal and opposite pairs on two different objects. When the forces on an object are balanced, the net force is zero and its motion does not change; unbalanced forces make it speed up, slow down or change direction.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-1, MS-PS2-2

What is a force?

Whenever you open a door, kick a ball or hold a bag, you are using forces. Forces explain why things start moving, stop, speed up, change direction or change shape.

Definition

A force is a push or a pull that one object exerts on another. Force is measured in newtons (N).

Key law

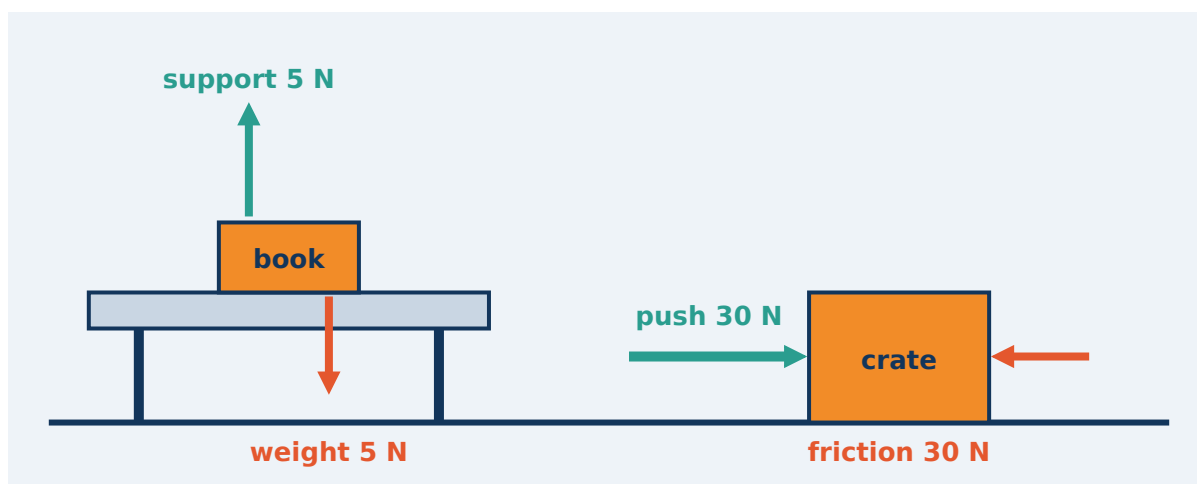
Forces always come in pairs. When object A pushes on object B, B pushes back on A with a force of equal size in the opposite direction. The two forces act on different objects.

If you push a wall with 40 N, the wall pushes back on your hand with 40 N. On a skateboard you would roll away, because the force of the wall acts on you.

What are contact and non-contact forces?

Some forces need the two objects to touch. Others act across a gap.

Type	How it acts	Examples
Contact force	The objects touch	Push, pull, friction, tension in a rope, air resistance, support force
Non-contact force	Acts across a gap	Gravity, magnetic force, electrostatic force

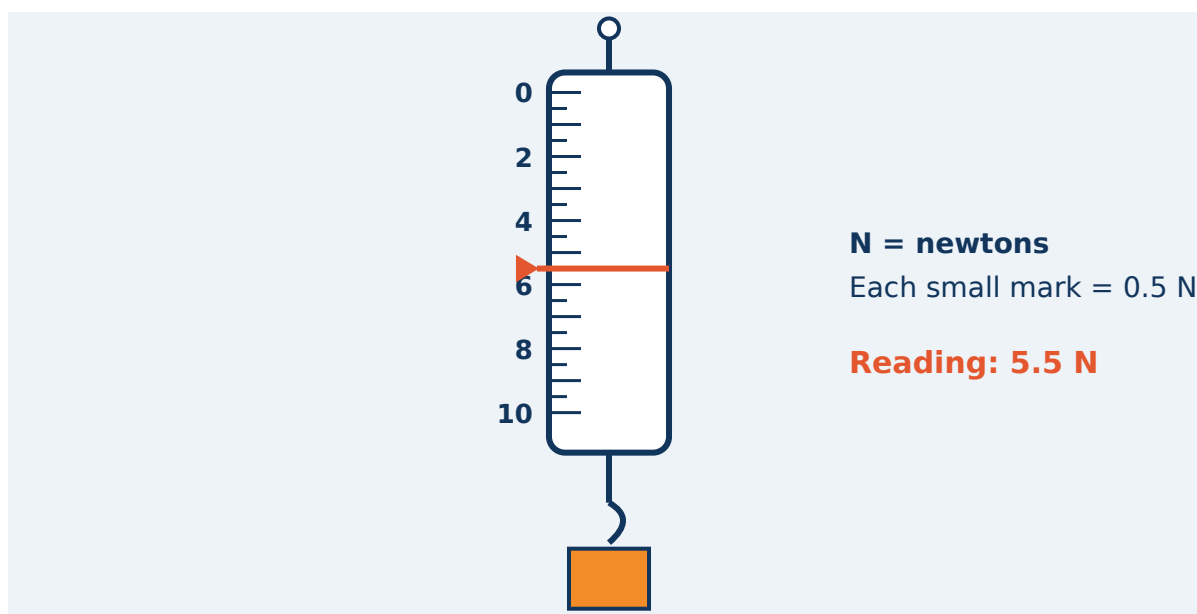


Left: a book at rest has two forces on it, which are equal and opposite. Right: a crate is pushed steadily while friction pushes back.

How do you draw and measure a force?

Forces have a size and a direction. We draw each one as an arrow. The arrow starts on the object, points in the direction of the force, and its length is proportional to the size. If 1 cm stands for 10 N, then a 30 N force is drawn 3 cm long.

A spring scale, also called a newton meter, measures force. The harder you pull, the more the spring stretches, and the pointer moves along the scale. Always read the scale at eye level and check that it starts at zero.



A spring scale reading 5.5 N. The scale runs from 0 to 10 N and each small mark is 0.5 N.

Worked example 1

A spring scale has a pointer exactly one mark below 6 N and the marks are 0.5 N apart. What does it read?

The mark below 6 N is $6.0 - 0.5 = 5.5 \text{ N}$.

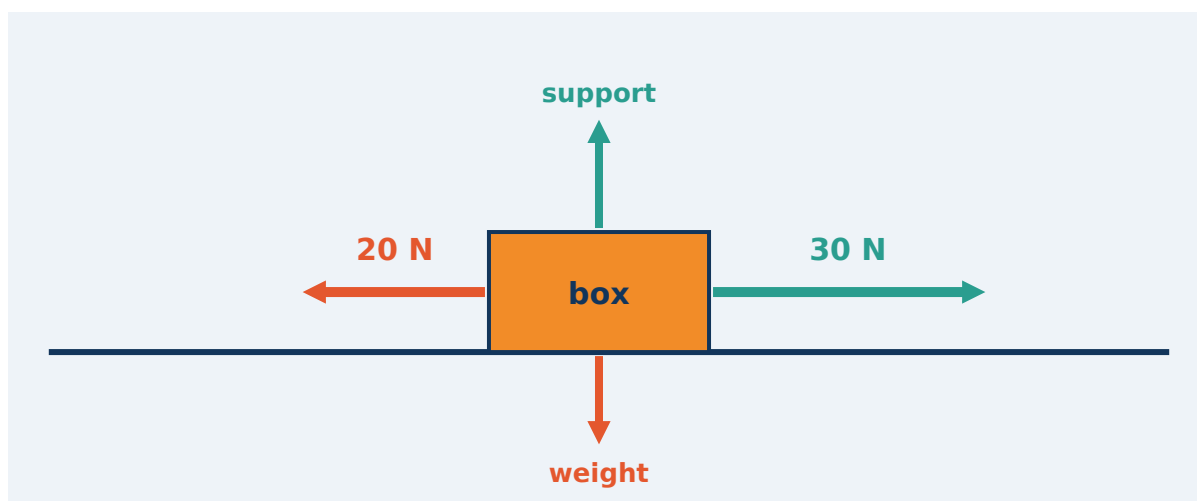
What are balanced and unbalanced forces?

Several forces can act on one object at the same time. To find their combined effect, add the forces that point the same way and subtract those that point the opposite way. The result is called the net force.

Definition

The net force is the overall force on an object after all the forces are added, taking direction into account. Forces are balanced when the net force is zero.

Situation	Net force	Effect on motion
Balanced forces	0 N	Object at rest stays at rest; moving object keeps the same speed in a straight line
Unbalanced forces	More than 0 N	Object speeds up, slows down or changes direction, in the direction of the net force



A box with a 30 N push to the right and 20 N of friction to the left. The horizontal forces are unbalanced; the vertical forces are balanced.

Worked example 2

In a tug of war in Karachi, team A pulls with 450 N to the left and team B pulls with 380 N to the right. Find the net force.

Net force = 450 N – 380 N = **70 N to the left**, so the rope accelerates towards team A.

Worked example 3

Ngozi pushes a trolley along a smooth corridor in Enugu at a steady speed. She pushes with 25 N. What is the friction force?

A steady speed means the forces are balanced, so friction is **25 N** in the opposite direction.

The size of the net force also matters. A larger net force produces a bigger change in motion. The same net force changes the motion of a heavy object less than that of a light one.

Common mistake

Many people think that a force is needed to keep an object moving. It is not. A moving object keeps going at constant speed with zero net force. You push a trolley only to cancel friction.

Lina's tip

Draw a quick free-body sketch for every problem: one dot for the object and one arrow for each force. Label every arrow with its size, then add left against right and up against down.

Key points to remember

- A force is a push or a pull; the unit is the newton (N), measured with a spring scale.
- Contact forces need touching (friction, tension); non-contact forces act across a gap (gravity, magnetism).
- Net force: add forces in the same direction and subtract forces in opposite directions.
- Balanced forces (net force 0 N) mean no change in motion; unbalanced forces change speed or direction.

Pushes, pulls and balanced forces: frequently asked questions

What is a force in simple words?

A force is a push or a pull. It can start an object moving, stop it, change its speed or direction, or change its shape.

What is the difference between contact and non-contact forces?

Contact forces need the objects to touch, like friction and tension. Non-contact forces act across a gap, like gravity and magnetism.

What is a newton?

The newton (N) is the SI unit of force. A small apple pulls down on your hand with a force of about 1 N.

What happens when forces on an object are balanced?

The net force is zero. An object at rest stays at rest, and a moving object keeps moving at the same speed in a straight line.

Why do forces come in pairs?

Every interaction involves two objects. When one pushes on the other, the second pushes back with an equal force in the opposite direction.