Forces

A force is a push or a pull that changes the motion or shape of an object. There are many types of force. Some require physical contact, such as when you kick a ball. Others, such as gravity and magnetism, are noncontact forces that work at a distance.

Forces at work

Several forces can act on an object at the same time. This picture shows the main forces acting on a climber abseiling down a cliff. Each force is represented by an arrow that shows the force's direction—forces are vector quantities (see page 66). The arrow's length here represents the size of the force.

Key facts

- ✓ **A force is a push or pull.**
- ✓ **A force can change the speed, direction of movement, or shape of an object.**
- ✓ **Forces can be contact or noncontact forces.**
- ✓ **The unit for force is the newton (N).**
- ✓ **Forces are vector quantities.**

Effects of forces

A force can have several effects on an object. Many forces affect the motion of an object—for instance, by making it speed up, slow down, or change direction. Forces can also change an object's shape.

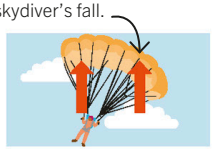
A force applied to a stationary object can make it move.

Gravity makes the skateboarder accelerate downhill.

When an object is already moving, a force in the same direction makes it move faster.

A force may also cause a moving object to change direction.

Air resistance slows the skydiver's fall.



A force in the opposite direction to a moving object makes it slow down or stop.

Tension bends the archer's bow.

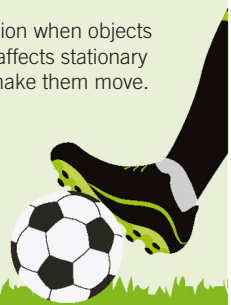
Forces can also cause temporary or permanent changes in an object's shape.

Types of force

Contact forces

Pushes and pulls are the contact forces we use to move things, from kicking a ball to tapping a keyboard.

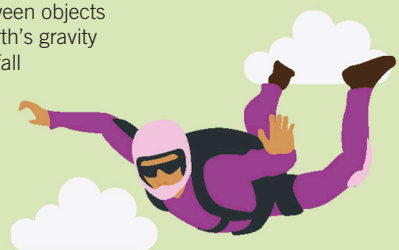
Friction is a force that opposes motion when objects rub or slide together. Static friction affects stationary objects and must be overcome to make them move. Kinetic friction is the force between moving objects and is weaker than static friction.



Air and water resistance are forces that objects moving through air and water have to overcome. They are caused by the push of air and water in the way. Like friction, these forces always act opposite to the direction of motion.

Noncontact forces

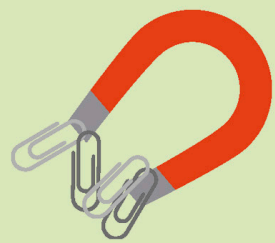
Gravity is a force of attraction between objects with mass. Earth's gravity makes things fall toward Earth.



Electrostatic force is the attraction or repulsion between objects with an electric charge.

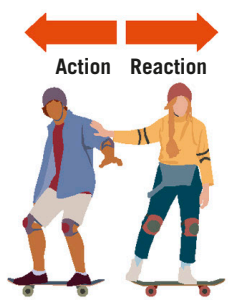
An electrostatic charge on a person's hair makes the hairs repel each other, causing them to stand on end.

Magnetism is the force experienced when a magnetic material is near a magnet.



Reaction forces

Reaction forces occur in response to every force but act in the opposite direction. If one skateboarder pushes the other, they will both move, as the push results in a reaction force acting in the opposite direction.



Newtons

The unit for force is named the newton (N) after the English scientist Isaac Newton. One newton is about the weight of an apple. The scientific definition of a newton is the force needed to accelerate a 1 kg object by 1 m/s^2.