Forces Knowledge organiser

A force is a push or a pull that is applied by one object on another.

Force is measured in newtons (N).

The size of a force can be measured using a newtonmeter.

Contact and non-contact forces

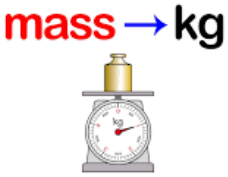
Contact forces – the objects are physically touching

Non-contact forces – the objects are physically separated

Contact forces	**Non-contact forces**
Friction Air resistance Water resistance Upthrust Tension Normal contact force Driving force Thrust	Gravity Magnetic Electrostatic

Mass and Weight

Gravity is a force of attraction between two masses. The force of gravity of the Earth pulls us towards it's centre.



Mass is the amount of matter in an object, measured in kilograms (kg) or grams (g).

Weight is the downward pulling force on an object due to gravity, measure in newtons (N).

We can calculate the weight of an object by using the equation:

Weight (N) = mass (kg) x gravitational field strength (N/kg)

On Earth the gravitational field strength is 9.8 N/kg.

Example – Calculate the weight of a man with a mass of 100kg.

Weight = 100kg x 9.8N/kg

= 100 x 9.8 = 980N

Force diagrams

Forces have a direction as well as size.

The size and direction of a force can be represented by arrows.

The longer the arrow, the larger the force.

5N to the right

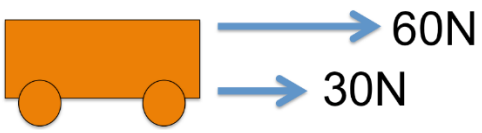
10N to the right

Resultant forces

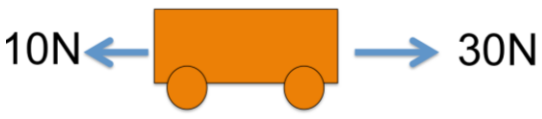
When there are several forces acting on an object we can work out what their combined effect is.

The combined force is called the resultant force.

Add up the forces acting in each direction and



Resultant Force = 90N to the right

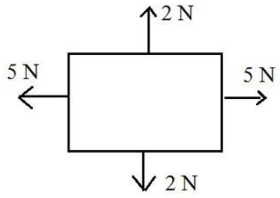


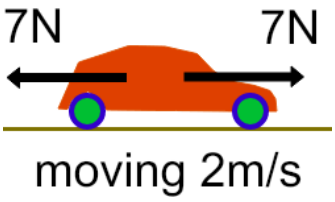
Resultant force = 20N to the right

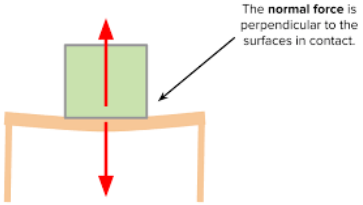
Newton's Laws of motion

Newton's First Law of Motion – Balanced forces

When the forces on an object are balanced (or there is no resultant force acting), the motion of the object does not change. If it is not moving it will remain stationary. If it is moving it will keep moving at the same speed in the same direction.



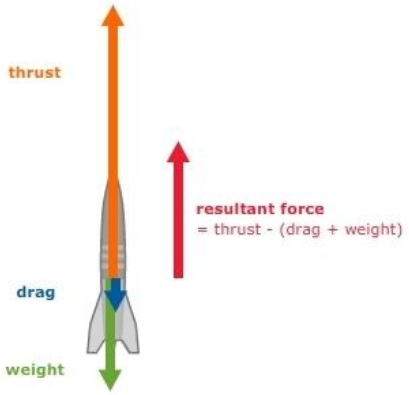


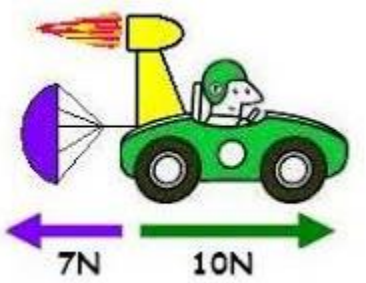


Newton's Second Law of Motion – Unbalanced forces

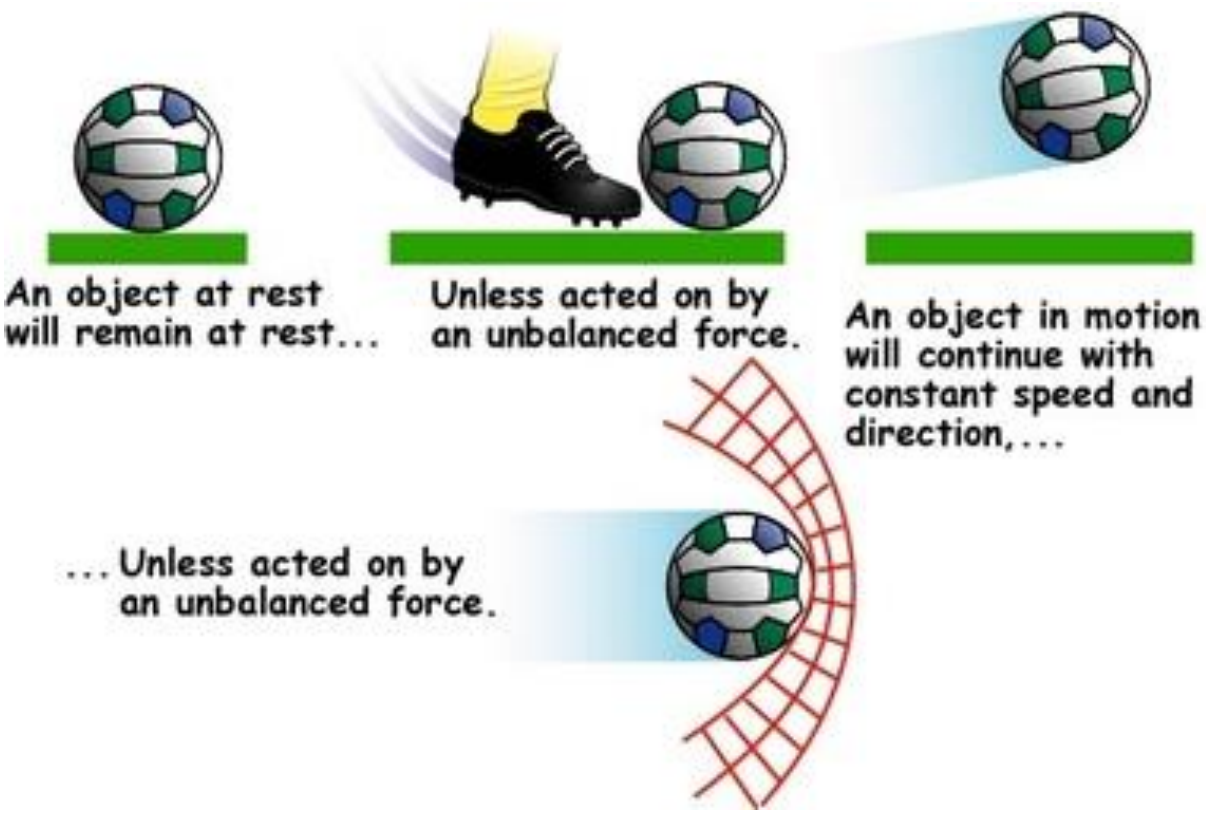
If there unbalanced forces (or a resultant force) acts on an object it will cause it to:

- Change speed
- Change direction
- Change shape





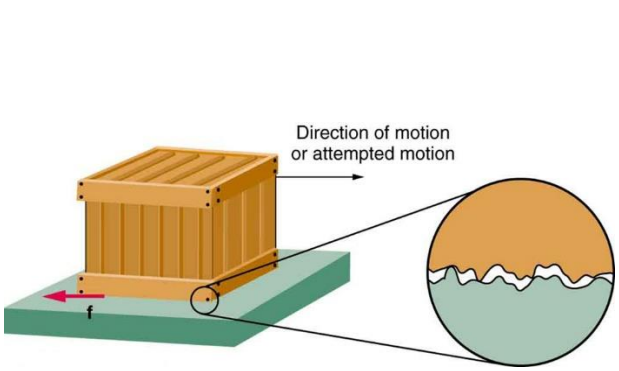
Example



Friction

Friction is a force that opposes motion (it slows objects down) and is caused by the contact of two objects.

Friction can be caused by the surfaces of two objects moving over one another, or by an object moving through a fluid such as air (air resistance) or water (water resistance).



Some objects are designed to reduce the amount of air resistance acting on them – we call these aerodynamic.

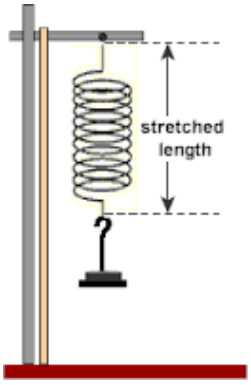
Hooke's Law - Springs and extension

Springs are made from coils of wire.

They can be stretched (made longer) or compressed (made shorter).

A spring is stretched by applying two forces:

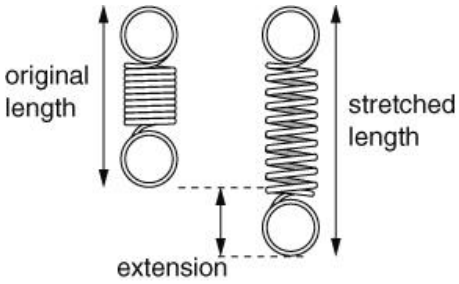
1. The weight of the block pulling down.
2. The bar pulling the top of the spring upwards.

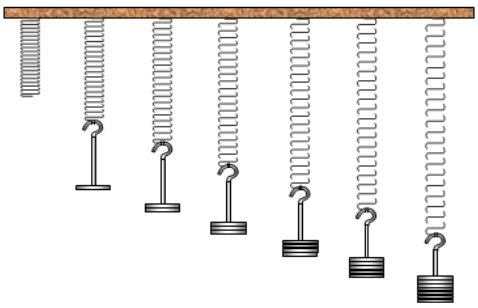


If the spring is not moving the forces must be balanced.

Elastic materials will stretch with a force and then return to their original shape when the force is taken away. Springs are elastic.

The extension of a spring is the difference between its original length and its stretched length.





The extension of a spring is directly **proportional** to the force on it. This is called **Hooke's Law**. The greater the force pulling down, the greater the extension of the spring.

If the spring is stretched too far, the extension stops being proportional to the force. If it is stretched even further, it goes beyond its **elastic limit**. The spring will no longer return to its original length when the force is removed.