

What is a force?

A force is something that causes a change in the position of an object.

A force can be described as a push, a pull or a turn.

Forces have both size (magnitude) and direction.

The unit of measurement of a force is the Newton (N)

Forces can be measured using Newton meters.



Year 7 Physics T1 - Forces

Forces can be categorised as contact or non-contact forces.

Contact forces require physical interaction for the force to be exerted (e.g. friction)

Non-contact forces can act at "a range". For example gravity and magnetism.

Friction is a contact force. Friction occurs when an object is moving and is in contact with another substance.

For example, if you push a book across a table, friction acts in the opposite direction to this motion.

Adding a lubricant can decrease the effect of friction. Friction can generate heat.

Air resistance is also a form of friction.

When a plane flies through the air, the air particles collide with it and apply a force in the opposite direction to the motion of the plane.

Air resistance can be decreased by making an object more streamlined/aerodynamic. This works by decreasing the size of the force acting on the object.

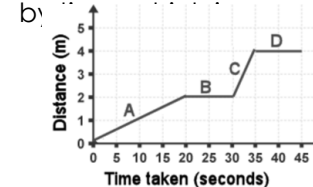
Friction can be investigated by dragging friction blocks across a table.



Adding more mass to the block will increase the amount of friction generated. This means a greater force needs to be applied to move the block.

Changing the surface of the block and/or the table will also change the amount of friction generated.

Distance time graphs show the distance that an object is travelling and the time it is taking to do so. The gradient of a distance time graph (the change in the y-axis divided by the change in the x-axis) is a measurement of distance divided



Section A shows a speed of 2m in 20s = 0.1m/s

Section B shows no change in distance which means it is stopped.

Section C shows a greater speed than section A because the gradient of section C is steeper than section A. Section C shows 2m travelled in 5s = 0.4m/s

Section D also shows a stopped object.

Speed is a measurement of how much distance is travelled in a certain amount of time.

Distance is measured in metres (m)

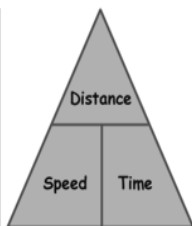
Time is measured in seconds (s)

Speed is measured in metres per second (m/s)

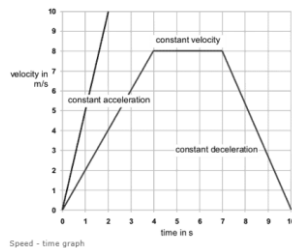
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$



Speed/velocity time graphs show how the speed of an object varies over time. The gradient (line) of the speed time graphs shows an object speeding up, slowing down or going a constant speed. This is therefore a measurement of the acceleration of the object.



Acceleration is measured in m/s²

Mass and Weight are two different things. The mass of an object is its ability to resist change (inertia). Mass is measured in kilograms (kg). The weight of an object is the force that the object exerts straight downwards because of both its mass and because of the strength of gravity.

Weight is measured in Newtons (N) because it is a force.

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

Gravitational field strength on earth is 9.8N/kg, so to find the weight of a 6kg box on earth: Weight = 6kg x 9.8N/kg = 58.8N.



$$\text{Weight} = 6\text{kg} \times 9.8\text{N/kg}$$

$$\text{Weight} = 58.8\text{N}$$



Year 7 Electricity & magnetism

Materials can be categorised as either conductors or insulators.

An electrical conductor will allow current to flow through it.

An electrical insulator will not allow current to flow through it.

Some conductors will be better at conducting than other conductors. The higher the current passing through a conductor, the better it is at conducting.

Resistance is a measure of how much current is "hindered."

In series, adding more resistors decreases the overall current

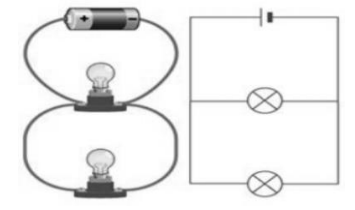
Electricity is the flow of electrons through a conductor.

Potential difference (Voltage) is the energy given to the electrons. The higher the voltage, the more energy the electrons have.

Current is a measure of how fast the electrons are flowing. If the electrons have more energy (higher voltage), then they flow faster (higher current)

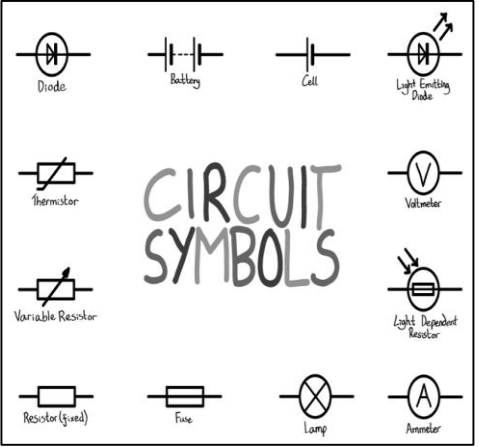
The higher the voltage, the higher the current.

Parallel circuits are circuits where components may be on different loops. If the cell provides, for example, 1.5v, then each loop gets its own 1.5V. Voltage is not shared in parallel.



Current, however is shared in parallel. The total current divides out between the branches. If one bulb breaks in the diagram above, the other one stays on because it gets its own voltage and current.

Resistance in parallel is very strange. Adding more and more resistance in parallel results in the total resistance going down!



Series circuits are circuits where all the components are in the same "loop":

In series circuit, the current is the same everywhere, and the voltage that is provided by the cell must be shared out amongst all the components.

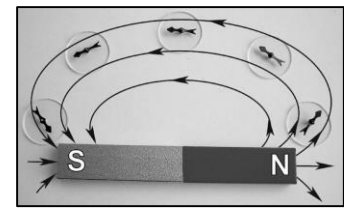
If more and more components are added in series, then more and more resistance is added. To find the total resistance in series, you add together the resistances of all the components.

Permanent magnets are magnets that are magnetic all the time.

Bar magnets are an example of permanent magnets. These have a north pole and a south pole.

The north pole of one magnet points towards the south pole of the closest, strongest magnet.

A compass needle will move to point towards the south pole of a magnet that it is near to so long as it is within the magnets magnetic field.



Resistance is a measure of how hard it is for electrons to move in an electrical circuit

voltage = current x resistance

$V = I \times R$

• Voltage is measured in volts (V).

• Current is measured in amps (A).

• Resistance is measured in ohms (Ω).

When using electricity, it is important to be safe. Mains electricity can shock and even kill a person.

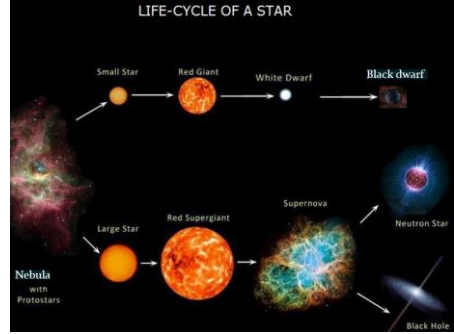
When working around electricity it is important to follow the following safety rules:

- Don't jam anything metal in to an electrical appliance
- Don't put liquids near electrical appliances.
- Don't overload plug sockets.
- Don't use electrical appliances that have damaged wires.

Electromagnets are not permanent magnets. We can make electromagnets by passing an electric current through a wire.

This makes the wire magnetic.

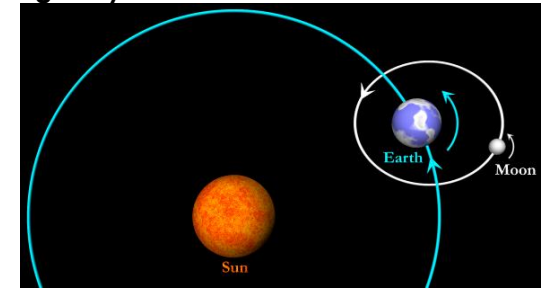
By coiling lots of wires around an iron core (e.g. a nail), we can make a very strong magnet. This will then pick up other magnetic materials. To turn the electromagnet off, we simply turn off the electric current.



The geocentric model of the solar system was the model of the solar system which placed the earth at the centre. According to this model, everything orbits around the earth. The heliocentric model is the model that places the sun at the centre of the solar system instead.



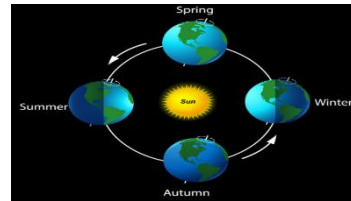
The orbits of planets and moons is because of **gravity**.



Stars are born and die in space. Stars can be categorised as either normal stars or massive stars. Normal stars like ours follow the life cycle shown at the top (Nebula – average star – red giant – white dwarf – Black dwarf)

Massive stars (stars that are at least 1.4 times more massive than our sun) will go from being a massive star to a red supergiant, followed by a supernova. Then, it will either become a black hole or a neutron star.

The seasons come about because the earth is slightly tilted. It is summer in the northern hemisphere when the northern hemisphere is tilted towards the sun. This results in greater intensity of solar radiation and longer days. When it is summer in the northern hemisphere, the southern hemisphere is tilted away from the sun, therefore the sun's rays are less intense and this makes it colder (winter).



The earth orbits around the sun, which takes 365.25 days to complete.

The moon orbits around the earth which takes about 29.5 days.

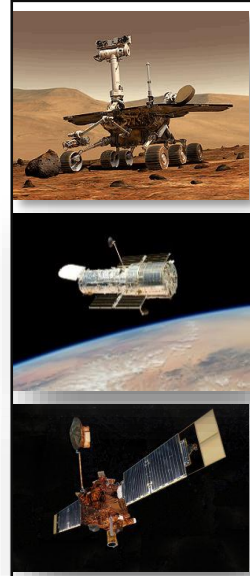
Since a calendar year is based on 365 days and not 365.25, every 4 years we have a leap year. This is where we have an extra day in February.

The earth also spins on its axis. It takes 24 hours for it to spin once, hence the length of a day is 24 hours.

Alien life is something that many astronomers are interested in. To date, scientists have discovered around 3,900 exoplanets. Exoplanets are planets which have been discovered orbiting around other stars.



Some of these planets are too close to their parent star and so would be too hot for life. Some are too far away from their parent star and so would be too cold. Planets that are at just the right distance are in what we call the "habitable zone." Scientists are very interested to find out if these planets could contain life.



To view distant planets we use space-based telescopes.

We can also gather information about planets in our own solar system using rovers and probes.

Our solar system is made up from planets, satellites (both natural and man-made) and dwarf planets.

Dwarf planets are planets that are too small to become spherical under the force of gravity.

The sun is actually a star, and is one of billions of stars that make up our galaxy (The Milky Way).

The universe is made up of billions of galaxies of different sizes.

Space is very big and so metres and kilometres tend to be too small to be practical in astronomy. Instead, we use units such as light years and astronomical units:

- o 1 light year is the distance that light travels in 1 year.
- o 1 Astronomical Unit (1AU) is the distance from the sun to the earth.

The universe is about 13.75 billion years old and began with an event called the "big bang". The universe has been expanding ever since and it appears to be speeding up in its expansion. Whilst there are theories about what will happen to our universe, no one knows for certain what the ultimate fate of the universe will be!