Use this booklet to help you revise the physics you have studied in Key Stage 3.

There are some ideas about how you can test yourself in the back of this booklet. Why not use BBC bitesize to help? [http://www.bbc.co.uk/bitesize/ks3/science/](http://www.bbc.co.uk/bitesize/ks3/science/)

Why not make a list of questions to test your friends with, or try and make a mind map of some of the key ideas?

Remember- a little and often is the best way to revise!
Sound vibrations and waves

**Sound** is a form of **energy**. Sounds are made when things **vibrate**. The vibrations are passed on by particles in solids, liquids or gases. Sound needs a substance to pass on the vibrations, so it can travel through solids, liquids and gases but not through a **vacuum**.

The speed of sound is faster through solids than liquids, and slowest through gases. This is because the particles are very close together in solids and so the energy is more likely to be passed from one particle to the next. The sound travels in all directions because the particles move in all directions unless something stops them.

![Sound waves can be shown on an oscilloscope.](image)

The **frequency** of a wave is the number of vibrations each second. The unit for frequency is **hertz** (Hz). If you listen to a sound with a frequency of 100 Hz, one hundred waves reach your ear every second. High **pitched** sounds have a high frequency, and low pitched sounds have a low frequency.

The distance between the waves is called the **wavelength**. It can be measured between any point on a wave and the same point of the next wave. It is often more convenient to measure it between the top of one wave and the next.

![Wave diagram with labels for amplitude and wavelength](image)

Half the height of the wave is called the **amplitude**. The **loudness** of a sound depends on the amplitude. Louder notes have more energy and the wave has a bigger amplitude.
Hearing and the ear

Sound waves travel through the air and into the ear. They cause the eardrum to vibrate. Sound can damage the ears if it is too loud or goes on for too long. Loud sounds can damage the eardrum or the cochlea. Unpleasant sound is often called noise.

We can measure how loud a sound is by using a sound intensity meter. This is an instrument which measures the loudness of a sound in decibels (dB). The threshold of hearing is the quietest sound we can hear and we say this is 0 dB.

Soft materials can absorb sound. Soft materials are used in soundproofing and for making ear protectors. Double glazed windows and soft materials like curtains help to reduce sound levels.

Sound and light

One major difference between light and sound energy is that light can travel through space (a vacuum) but sound cannot.

Light also travels much faster than sound. It is nearly a million times faster. Light travels at 300 million metres per second (or 300 000 km/s) and sound travels at about 330 metres per second.

Both light waves and sound waves can be reflected. We hear a reflected sound wave as an echo.
Light

Objects which create light are luminous sources. Light travels in straight lines. (Always draw rays of light with pencil and ruler—especially on TESTS!)

Light waves travel through transparent objects but not through opaque objects. Shadows are made because light cannot travel through opaque objects. Translucent objects show a glow of light through them.

Transmission and absorption
Transparent materials let light pass straight through. We say they transmit light. Opaque surfaces can absorb light. Black surfaces absorb light very well and reflect very little. This is why they look so dark.

Reflection
Light rays are scattered by rough surfaces, and a reflection cannot be seen. A plane mirror is a flat mirror. Light is reflected evenly by a plane mirror.

The angle of incidence is equal to the angle of reflection.
When light shines on to an object viewed in a mirror, the rays are reflected into the eye. They seem to come from a position behind the mirror. The image is the same size as the object and the same distance from the mirror. In the image left is right and right becomes left.

Refraction
When light hits something transparent it changes direction. This is called refraction.

Refraction takes place at the interface between two substances. When light is transmitted through glass it slows down and bends towards the normal. When it travels back out it speeds up again and bends away from the normal.
Colour

White light is a mixture of colours. White light can be split up using a prism to give a spectrum of seven colours (red, orange, yellow, green, blue, indigo, violet).

The splitting of colour into a spectrum is called dispersion.

A rainbow is produced when water droplets in the air refract sunlight.

Different colours can be made by mixing light of the three primary colours (red, green and blue).

Coloured light can be made using a filter. A red filter lets red light through, but absorbs all the other colours.

We are able to see colours because objects do not reflect all the colours in light:

White objects reflect all the colours.
A red object only reflects red and all other colours are absorbed.
This idea applies to all colours except black.
Black objects absorb all colours.

Energy and electricity

Nothing would happen without energy. Energy is needed to:

- keep our bodies working
- make machines work
- heat homes, schools and offices.

Energies in action
- heat energy
- light energy
- sound energy
- electrical energy
- kinetic (movement) energy.

Stored energy
Some energy has to be stored so that it is ready for use when we need it.
- Chemical energy is stored in food, fuels and cells.
- Gravitational potential energy is stored in high up things.
- Strain energy is stored in stretched or squashed things.
- Nuclear energy is stored inside atoms.

**Energy changes**

Energy needs to be changed to be useful.

An energy flow diagram.

Many energy changes take place in everyday life. Often wasted energy is produced in the forms of heat or sound.

A car engine produces kinetic energy, which is useful. It also produces heat and sound.

Energy cannot be made or destroyed, but can only be changed from one form to another. This is the **law of conservation of energy**.

**Voltage**

A circuit must have a cell or power supply to provide a **voltage**. The voltage pushes the **electrons** around the circuit and gives them energy. This electrical energy is **transferred** to other components in the circuit, which convert it to other forms of energy. For instance, a light bulb transfers electrical energy to heat and light energy.

The voltage of a cell can be measured using a **voltmeter**. The units for voltage are **volts (V)**. The voltage across a component is a way of measuring how much energy the component is transferring. The voltage across all the components in a series circuit adds up to the voltage across the cell.
Wasting energy

Energy cannot be made or destroyed, but it can be changed to different forms. Not all energy is turned into a form that we want. Often it is turned into heat that we do not need. This is wasted energy. A car engine produces kinetic energy, which is useful. It also produces heat and sound which are wasted forms of energy.

The percentage of useful energy produced by something is known as its efficiency. The human body is 25% efficient.
**Series & parallel circuits**

There are two types of circuit we can make, called series and parallel. The components in a circuit are joined by wires.
- if there are no branches then it's a series circuit
- if there are branches it's a parallel circuit

Series circuits
In a television series, you get several episodes, one after the other. A series circuit is similar. You get several components one after the other.
If you follow the circuit diagram from one side of the cell to the other, you should pass through all the different components, one after the other, without any branches.

![Series Circuit Diagram](image1)

If you put more lamps into a series circuit, the lamps will be dimmer than before.
In a series circuit, if a lamp breaks or a component is disconnected, the circuit is broken and all the components stop working.

![Series Circuit with Broken Lamp](image2)

Series circuits are useful if you want a warning that one of the components in the circuit has failed. They also use less wiring than parallel circuits.

Parallel circuits
In parallel circuits different components are connected on different branches of the wire. If you follow the circuit diagram from one side of the cell to the other, you can only pass through all the different components if you follow all the branches.

![Parallel Circuit Diagram](image3)

In a parallel circuit, if a lamp breaks or a component is disconnected from one parallel wire, the components on different branches keep working. And, unlike a series circuit, the lamps stay bright if you add more lamps in parallel.
Parallel circuits are useful if you want everything to work, even if one component has failed. This is why our homes are wired up with parallel circuits.