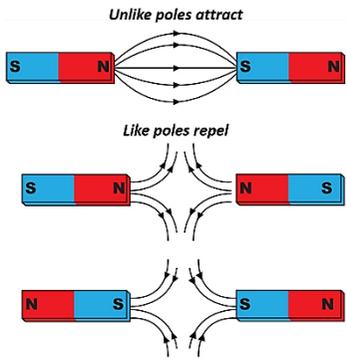


## Knowledge organiser – 7.4 Magnetism and Electromagnets

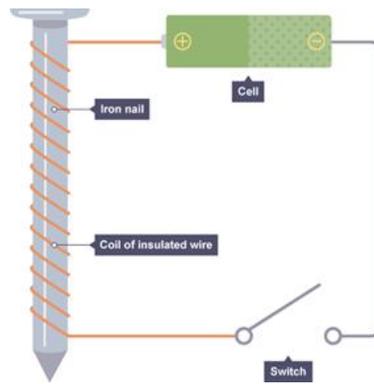


Magnetic materials are always made of metal, but not all metals are magnetic. Iron, steel, cobalt and nickel will experience a magnetic force.

The Earth's magnetic field is the same as that of a bar magnet. The field lines are most concentrated at the poles. The south pole is at the top of the planet.

### MAGNETIC FIELD

- You can find the shape of a magnetic field by using a plotting compass or using iron filings.
- Magnetic field lines go from north → south.
- If the field lines are close together, this means the magnetic field is stronger.
- Permanent magnets and wires with current flowing through will have a magnetic field.



### MAKING AN ELECTROMAGNET

When an electric current flows in a wire, it creates a magnetic field around the wire. This effect can be used to make an electromagnet. A simple electromagnet comprises a length of wire turned into a coil and connected to a battery or power supply.

#### How can you make an electromagnet stronger?

- Adding more turns to the coil
- Increasing the current flowing through the coil
- Use a magnetic material for the core (e.g. iron)

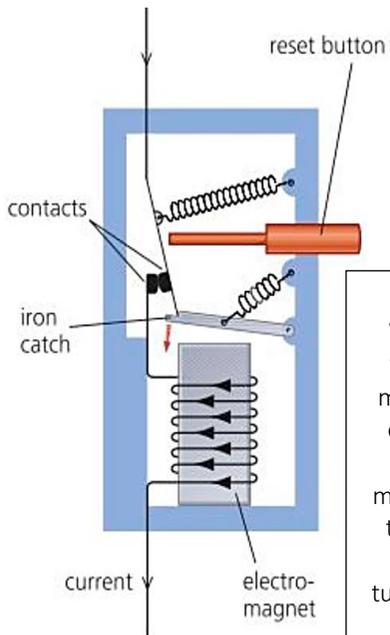
#### How does the strength of an electromagnet vary with distance?

The strength of a magnetic field decreases as the distance increases.

#### Magnetic field

The magnetic field around an electromagnet is just the same as the one around a bar magnet. It can, however, be reversed by reversing the current (turning the battery around).

KEYWORD	DEFINITION
<b>Circuit breaker</b>	A device that uses an electromagnet to break a circuit if the current is too big.
<b>Core</b>	Soft iron metal which the solenoid is wrapped around.
<b>Electric bell</b>	A device that uses an electromagnet to make sound using a 'make and break' circuit.
<b>Electromagnet</b>	A non-permanent magnet turned on and off by controlling the current through it.
<b>Loudspeaker</b>	A device that uses an electromagnet to make sound from a varying potential difference. Turns an electrical signal into a pressure wave of sound.
<b>Magnet</b>	A material with a magnetic field around it in which a magnetic material experiences a force.
<b>Magnetic field</b>	A region in which there is a force on a magnet or magnetic material.
<b>Magnetic field lines</b>	Imaginary lines that show the direction of the force on a magnetic material.
<b>Magnetic force</b>	Non-contact force from a magnet on a magnetic material.
<b>Magnetic poles</b>	The ends of a magnetic field, called north-seeking and south-seeking poles.
<b>Magnetise</b>	To make a material magnetic.
<b>Permanent magnet</b>	An object that is magnetic all of the time.
<b>Solenoid</b>	Wire wound into a tight coil, part of an electromagnet.

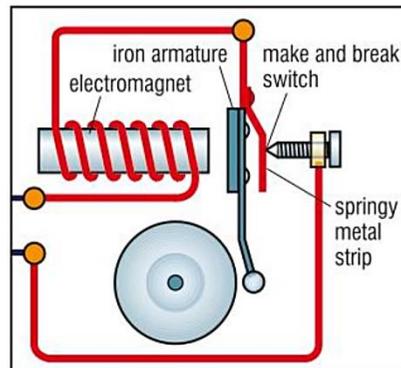


### ELECTRIC BELL

The electromagnet attracts iron armature. When the armature moves, the circuit breaks (current does not flow). The coil and core are no longer magnetic and the springy metal strip returns to its original position and the bell rings once. The circuit is complete again, so the armature moves and the bell rings again.

### CIRCUIT BREAKER

When a large current flows in the wire, the magnetic field is strong enough to attract the iron catch. The catch moves down and breaks the circuit. The circuit stays off and can be turned on with the reset button.



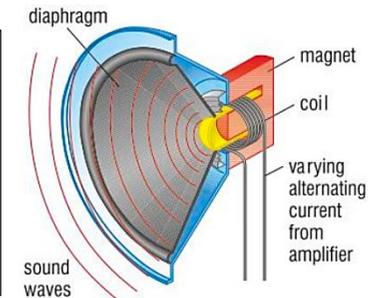
A steel core (although harder to magnetise than iron) will keep its magnetism. It will stay magnetic, when you turn the current off.

### USES OF ELECTROMAGNETS

Electric bells and buzzers, loudspeakers, MRI machines, scrapyards machines, magnetic levitation (maglev trains), circuit breaker and relays.

### LOUDSPEAKER

The electric current from your phone flows in a coil of the wire. The coil becomes an electromagnet. A magnet inside, attracts and repels the electromagnet making the cone move in and out. This makes a sound.



### PERMANENT VS ELECTROMAGNET

- Electromagnet can be turned on and off.
- You can vary the strength of an electromagnet.