Topic: Electricity A: Circuits

Duration:

Composite: Unit test

Key vocabulary:

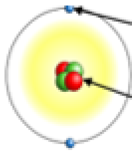
- Circuit
- Potential difference
- Voltage
- Current
- Resistance
- Ohm
- Amp
- Volt
- Series
- Parallel
- Branch
- Junction
- Component
- Voltmeter
- Ammeter
- Power
- Charge
- Equation
- Resistor
- Filament Lamp
- LDR
- Thermistor
- Variable resistor
- Cell
- Battery

Core knowledge Components

Powerful knowledge components crucial to commit to long term memory - Questions in bold, (C)

Electricity A: Circuits

What are atoms made of? (C)

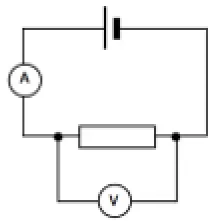


Around the outside of an atom are **electrons**, which have a **negative charge**.

The nucleus at the centre of an atom contains **protons**, which have a **positive charge**.

What are the properties of the sub-atomic particles? (C)

Subatomic particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
electron, e⁻	1/2000	-1



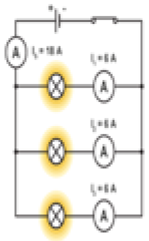
How is a voltmeter connected to measure potential difference across a component? ***In parallel***

How is an ammeter connected to measure the current flowing through a component? ***(In series)***

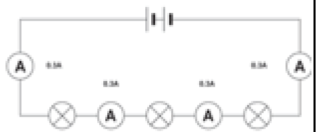
How do we define potential difference? ***PD is the energy transferred per unit charge passed and hence that the volt is a joule per coulomb***

How do we define an electrical current? ***An electric current is the rate of flow of charge***

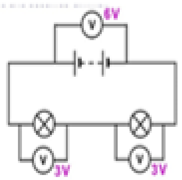
What are the key differences between series and parallel circuits? (C)



In a series circuits the current flowing is the same in every part of that circuit:

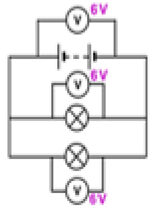


In a parallel circuit, the current is split between branches.



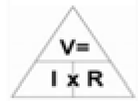
In a series circuit the potential difference from the power supply is shared across the components

In a parallel circuit each branch has the same potential difference across it



What equation links potential difference, current and resistance?

V = I x R



What equation links charge, current and time?

$$I = \frac{Q}{t}$$

I = Current
Q = Total charge
t = time taken

What equation links power, energy transferred and time? (C)

$$P = \frac{E}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}}$$

What equation links energy transferred to potential difference, current and time?

$$E = VIt$$

What equation links power to potential difference and current? (C)

$$P = I \times V$$

What equation links power to current and resistance?

$$P = I^2 \times R$$

How does changing resistance in a circuit affect current? (C) ***Increasing the resistance will decrease the current. Decreasing the resistance will increase the current***

What does a variable resistor do? ***It changes the current within a circuit***

How can unwanted energy transfer in wires be reduced? ***By using wires with lower resistance***

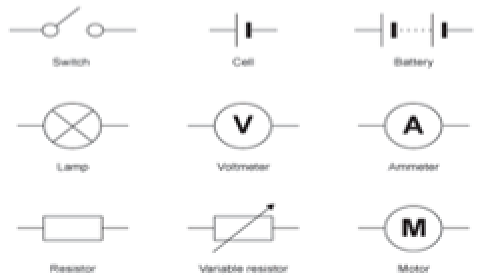
Why does an electric current have a heating effect? ***This is due to electrons colliding with metal ions within a lattice***

What are the benefits and disadvantages of the heating effect of a current?
Benefits:
Can be used in a variety of appliance to transfer energy as heating e.g. toaster, heater, kettle

Disadvantages:
Causes appliances to be inefficient, energy is dissipated to the surroundings

What properties do LDRs and Thermistors have?
LDR: Resistance increases with lower light intensity
Thermistor: Resistance increases as temperature gets lower

What circuit symbols do I need to know?



Links to previous and future topics

Year 7 Electricity
Year 7 Energy
Year 9 Energy
Year 10 Conservation of Energy
Year 11 Electricity B: Using Electricity in the Home
Year 11 Magnetism

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
			Students will need to be taught how to test circuits themselves and to problem solve circuits.	Many electrical and engineering career paths available with this knowledge.

Topic: Electricity B: Using Electricity in the Home

Duration: 3 lessons

Composite: Unit test

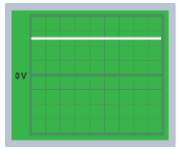
Key vocabulary:

- Alternating
- Direct
- Current
- Potential Difference
- Mains
- Frequency
- Live
- Neutral
- Earth
- Terminal
- Circuit breaker
- Power rating
- Fuse

Core knowledge Components

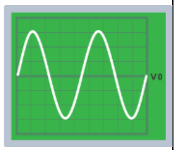
Powerful knowledge components crucial to commit to long term memory - Questions in bold, (P)

What is the difference between direct and alternating current? (P)



A direct current flows in one direction only

In an alternating current the direction of charge movement regularly changes



What type of current do cells and batteries supply?

Cells, batteries and solar cells all supply direct current

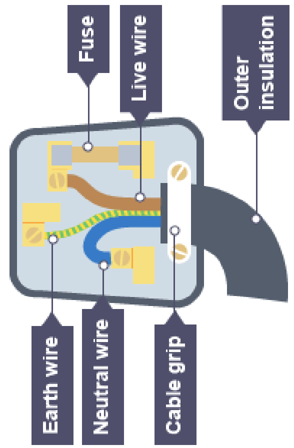
What is the frequency and voltage of mains domestic electricity supply in the UK?

50Hz, a.c. 240V

What are the functions of the live, neutral and earth wires? (P)

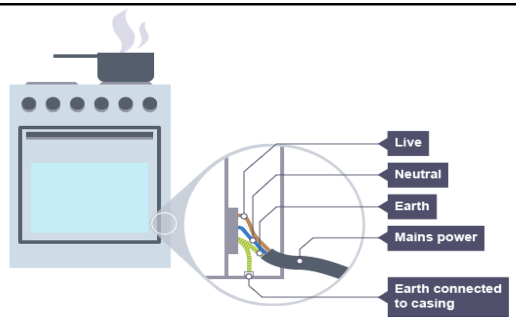
What are the potential differences between the live, neutral and earth wires?

Wire	Function
Live wire	Copper wire coated with brown plastic - this wire connects to the alternating potential difference pushing the current in the circuit
Neutral wire	Copper wire coated with blue plastic - this wire is connected to a voltage close to zero, to ensure the live voltage always has a difference in potential to make the push for the current
Earth wire	Copper wire coated in striped plastic that provides a path for current to flow from the case of the device to the ground (also a zero-voltage connection) if there is a fault



How does earthing work?

The earth wire is connected to the case and is attached to a metal plate. The earth wire provides a low resistance path to the ground. In the event of a fault, the live current passing through the case will follow this path to the ground instead of passing through a person. Once the fuse has melted, the circuit is broken and no more current flows through the device. This means the case of the device is no longer live and there is no more risk of electrocution.



How does a circuit breaker work?

A circuit breaker can serve the same function as a fuse but can be reset without the need for replacement if it trips.

The fuse or circuit breaker must be connected in the live wire side of a domestic circuit to ensure that it keeps high voltage from reaching the user, or surroundings, if a fault develops.

Links to previous and future topics

Year 7 Electricity
Year 7 Energy
Year 9 Energy
Year 10 Conservation of Energy
Year 11 Electricity A: Circuits
Year 11 Magnetism

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
				Many electrical and engineering career paths available with this knowledge.

CULTURAL CAPITAL:

SEND

- Opening activity/theme is … to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge via Knowledge Recall slide
- Multi-sensory approach using video, practical work, teacher explanation/modelling, paired work
- Technology: video used to support accessibility
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning

Topic: Static Electricity (Separate Physics Only)	Duration:	Composite : Unit test

Key vocabulary :

Insulators
Charge
Static
Induction
Electron
Discharge
Earthed
Electrostatic
Field
Force field
Electric field
Point charge
Field lines
Electrode
Uniform

Core knowledge Components

Sparking and Forces Exerted:-

Sparking occurs when enough charge builds up, and the objects are close but not touching
- The "spark" is when the charge jumps through the air from the highly negative object to the highly positive object, to balance out the charges
- Lightning occurs when the charge difference between clouds and the Earth becomes so great, and a massive spark (lightning) jumps across to balance the charge

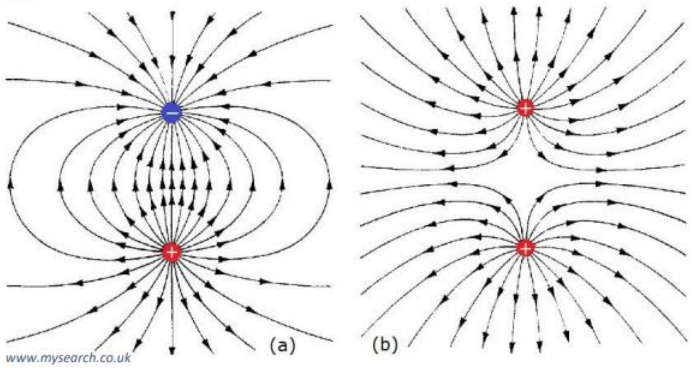
- The charged objects experience a force – electrostatic force (of attraction/repulsion)
- Greater charge = greater force (e.g. a more positive object, a more negative object)
- Closer together = greater force (force is proportional to the inverse square of the distance)
  - It is a noncontact force, as force can be felt even when the objects are not touching

Like charges repel, and unlike charges attract
- A positively charged balloon next to wall attracts electrons in the wall
  - This induction causes the balloon to stick to the wall
- Comb charged induces the opposite charge in small pieces of paper, so picks them up

Electric Fields

- Like magnetic fields for magnets, electric fields are for charges
  - An electric field is the region where an electric charge experiences a force
  - They point in the direction a positive charge would go
    - I.e. away from positive charges, and towards negative charges
  - They point to charges at right angles to the surface
- Stronger the charge, the more field lines present and the stronger the force felt
- Parallel plates have a uniform field

Diagrams



Powerful knowledge components crucial to commit to long term memory

- A property of all matter
- Positive and negative charges exist
  - If a body has the same amount of positive and negative charge, they cancel out, forming a neutral body (i.e. protons and electrons in a neutral atom)
- Like Charges repel
- Opposite charges attract

Insulators do not conduct electricity
- Their electrons cannot flow throughout the material, they are fixed

Conductors can conduct electricity
- Their electrons can flow, and are not fixed (they are delocalised)

- When two insulators are rubbed together it can be charged by friction
  - Electrons are transferred from one object to the other
  - Forming a positive charge on one object and a negative charge on the other
- If conductors were rubbed, electrons will flow in/out of them cancelling out any effect, so they stay neutral
  - Insulators become charged because the electrons cannot flow
  - A positive static charge forms on object which loses electrons
  - A negative static charge forms on object which gains electrons
- Which object loses/gains electrons depends on the materials involved

Earthing:-

- This allows electrons to flow to the earth, removing excess charge
  - This allows materials to stay neutral

- if charge builds up and a spark forms when fuelling cars, it could ignite and cause a massive explosion
  - As fuel passes through a hose to the vehicle, a static charge can build up
  - When it is too large a spark might form
  - A resulting spark might ignite the fuel
  - The hoses are earthed to stop this occurring

Links to previous and future topics

Y8 – Electricity, Magnetism
KS4 – Electricity; Magnetism and Chemistry topics involving movement of electrons (e.g. bonding)
KS5 – Electric Circuits; Electric Fields; Magnetic Fields

	Applications: - Insecticide sprays are sprayed from aircraft, and given a charge - This means the spray droplets repel each other - So the droplets spread evenly, and are attracted to the earth o If not charged, there is a risk that some droplets will blow away, or the spray will fall unevenly		

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Research the uses and dangers of static electricity	Is it difficult to remove electrons from atoms – what would we need (it is likely that they will think it is difficult and will require a chemical reaction)	Research the uses and dangers of static electricity Explain how a balloon is able to stick to a wall as a result of charging by induction.	Construct electric field diagrams for various point charge and parallel plate arrangements	Automotive Engineers, Crop Sprayers/Farmers, Electrical and Electronics Engineers, Meteorologists

SEND

- Opening activity/theme is Knowledge Recall &Topic pathway slide to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge – Knowledge Recall & Topic Test.
- Multi-sensory approach using reading, writing, listening, watching, practical work, teacher observations…
- Dropping feather and hammer on the Moon case study chosen to support cultural capital as relatable
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning – the, now, next
- Opportunities for low entry/high ceiling activities
- Activities are scaffolded with over-learning of previous content to encourage independence

Topic: KS4 FORCES AND MATTER

Duration: 4 Lessons

Composite: Unit test

Key vocabulary:

Force
Stretch
Compress
Elastic
Inelastic
Plastic
Deformation
Linear
Non linear
Hooke
Proportionality
Energy
Work done
Potential

Core knowledge Components
Powerful knowledge components crucial to commit to long term memory (IN RED BOX)

KS4 FORCES AND MATTER

SPRINGS:

Stretching, Bending and Compressing:-
- More than one force has to be applied

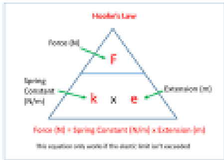
o If a single force is applied, the object will just move in the force's direction

o If forced inwards from opposite sides, the object (e.g. a spring) will compress

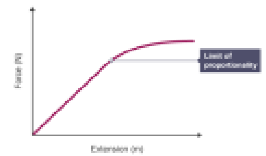
o If fixed at one end of the spring and a force is applied at the other, more than one force is still being applied to the spring (a reaction force from the fixed point)

Deformation:-
- This means changing shape
- **Elastic Deformation**
  - o The object returns to its original shape when the load/force has been removed
  - o Eg. An elastic band
- **Plastic Deformation** (distortions)
  - o The object does not return to its original shape when the load has been removed
  - o Eg. A spring when pulled too far

Linear Elastic Distortions, Hooke's Law
- Spring constant k = Force required to extend a spring by one metre
- Hooke's Law: The extension of a spring is directly proportional to the force applied.
- Directly proportional means e.g. that if force doubles, extension doubles.
- It will be a **linear (straight line)** graph starting at the origin.



Limit of Proportionality/Elastic Limit:-
- **Spring constant** is a measure of the stiffness of a spring up to its limit of proportionality or elastic limit.
- The **limit of proportionality** is the point beyond which Hooke's law is no longer true when stretching a material.
- The **elastic limit** of a material is the furthest point it can be stretched or deformed while being able to return to its previous shape.
- Once a material has gone past its elastic limit, its deformation is said to be **inelastic**. The graph curves at this point. The material will not return to its original length.

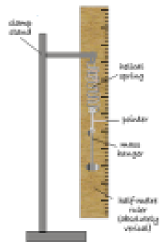


Energy stored in a spring:-
- Work is done when a spring is extended or compressed.
- Elastic potential energy is stored in the spring.
- Provided inelastic deformation as not occurred:-

Work done = Elastic Potential Energy
(Both are measured in Joules, J)

Hooke's Law Investigation

Variables:-
Independent = mass added to spring
Dependent = extension of spring
Control = material of spring, original length of spring, person judging extension length
NB: pointer; absolutely vertical ruler
Consider: range (need change but not overstretch); safety
Plot graph of F against e:
- gradient = spring constant
- Area under line = Work done



Links to previous and future topics

Y7: Forces and Space

Y9: Forces in a Newtonian World, Motion & Pressure

KS4: Forces, Energy – Forces doing Work; Forces & their Effects, Conservation of Energy

KS5 Physics: Forces in Action; Work, Energy and Power

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Linking Physics and Springs to the human body:- https://www.nhs.uk/conditions/hamstring-injury/ What is the link between Physiotherapy and this topic? https://www.nhs.uk/conditions/physiotherapy/	Identify forces acting on objects stretching, compressing, bending or none of the above	Linking topic with muscle injury and Physiotherapy	Required practical: Investigating Hooke's Law	Architect, Product design, Civil and Aeronautical Engineering, Geophysicist, Physiotherapist, Sports Scientist

CULTURAL CAPITAL: Understanding the link between Hooke's Law, hamstring injury and Physiotherapy

SEND

- Opening activity/theme is Knowledge Recall to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge using Knowledge Recall.
- Multi-sensory approach using reading, listening, watching, doing practicals, talking, observing demonstrations…
- Muscle injury/physiotherapy link case study chosen to support cultural capital at KS4/KS5
- Muscle injury/physiotherapy link case study chosen as it is relatable and for career opportunities/aspirations beyond school.
- Muscle injury/physiotherapy topic chosen due to cross curricular links with PE supporting non-verbal reasoning
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning – then, now, next
- Activities are scaffolded with over-learning of previous content to encourage independence

Topic: PARTICLE MODEL – Physics Combined Science & Separate Physics

Duration: 9 LESSONS

Composite: Unit test

Key vocabulary:

Particle
State
Melting
Solidification
Boiling
Evaporation
Condense
Sublimation
Density
Energy
Specific heat capacity
Specific latent heat
System
Temperature
Pressure
Volume
Kelvin

Core knowledge Components

Powerful knowledge components crucial to commit to long term memory (IN RED BOX)

KS4 PARTICLE MODEL

Density

- Depends on the spacing of the atoms in matter
- Solids and liquids have similar densities as the space between particles is similar.
  - Usually liquids have a lower density than solids (main exception is ice and water)
  - Gases have a far lower density

  spacing between atoms increases x 10
  - particles have lots of kinetic energy
  - volume increases greatly
  - density decreases

Heating a System

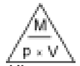
- Heating increases the energy the particles have
- Particles vibrate more
- This either raises the temperature of the system Or produces a change of state
- The 'system' could be an ice cube, a gas etc…

Absolute Zero

- This temperature is 0 Kelvin, or -273°C
- the coldest possible temperature
- Particles at this temperature have no energy, so they do not vibrate at all, they remain perfectly still.

Converting Kelvin to Centigrade:
T kelvin = (T – 273) centigrade
so 4K = –269°C and 0°C = 273K
- the difference of 1°C is the same as 1 Kelvin

density = mass / volume

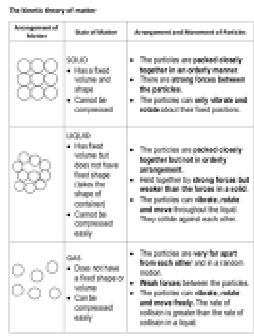


density (p) is measured in kilograms per cubic metre (kg/m3)
mass (m) is measured in kilograms (kg)
volume (V) is measured in cubic metres (m3)

Temperature Changes

Specific Heat Capacity: The amount of energy required to raise the temperature of 1kg of a substance by 1°C.

Specific Latent Heat : The amount of energy needed to change the state of 1kg of a substance without a change in temperature.



The kinetic theory of matter

Arrangement of Matter	State of Matter	Arrangement and Movement of Particles
	SOLID • Has a fixed volume and shape • Cannot be compressed	• The particles are packed closely together in an orderly manner. • There are strong forces between the particles. • The particles can only vibrate and rotate about their fixed positions.
	LIQUID • Has fixed volume but does not have fixed shape (takes the shape of container) • Cannot be compressed easily	• The particles are packed closely together but not in orderly arrangement. • Held together by strong forces but weaker than the forces in a solid. • The particles can vibrate, rotate and move throughout the liquid. They collide against each other.
	GAS • Does not have a fixed shape or volume • Can be compressed easily	• The particles are very far apart from each other and in a random motion. • Weak forces between the particles. • The particles can vibrate, rotate and move freely. The rate of collision is greater than the rate of collision in a liquid.

Specific Latent Heat

$E = m \times L$

E = Energy in Joules, J
m = mass in kilograms, kg
L= specific latent heat in Joules per kilogram, J/kg.

- Energy is absorbed when melting and evaporating
- Energy is released when freezing and condensing.

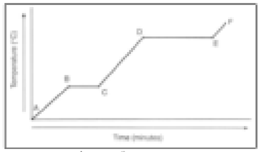
Specific Heat Capacity

$\Delta E = m \times c \times \Delta T$

ΔE: change in thermal energy, in Joules J,
C = specific heat capacity, in Joules per kilogram per degree Celsius, $Jkg^{-1}°C^{-1}$,
m = mass kilograms, kg
ΔT = temperature change in degrees Celcius °C .

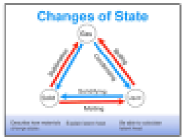
Graph here shows the temperature of ice:

- At A it is Solid.
- At B, reaches 0°C .
- From B to C there is no temperature change because the energy is involved in melting.
- From C to D it is in liquid state.
- From D to E the water is changing state. It is boiling. This takes longer, because evaporation takes more energy.
- From E to F the gas is heating.



Changes of State

- Mass is conserved during a change of state.
- These physical changes are reversible, and not chemical changes
- They are not chemical because the material retains its original properties when reversed



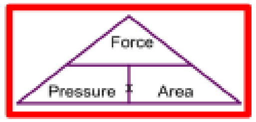
Pressure of a Gas

- Particles in a gas move randomly in every direction
- A Fluid can be a liquid or a gas
- Pressure produces a net force at right angles to any surface
- Particles collide with a wall, changing velocity
- This means they change momentum during their collision
- So they exert a force on the wall (as force = Δmomentum time)
- Pressure is the force across the area of the wall.

Temperature and Pressure (in a constant volume)

- Increased temperature means more energy given to the particles
  - The thermal energy is transferred to kinetic

o Particles move at faster speed
o Collisions with walls occur more often
o The particles also hit the wall with greater impact
o So pressure increases



Links to previous and future topics

Y7: Forces & Space; Particles & Solutions

Y8: Heating and Cooling

Y9: Energy; Motion & Pressure

KS5 Physics: Thermal Physics, Ideal Gases

PARTICLE MODEL KS4 SEPARATE SCIENCE PHYSICS ONLY

Pressure changes (Physics Only)

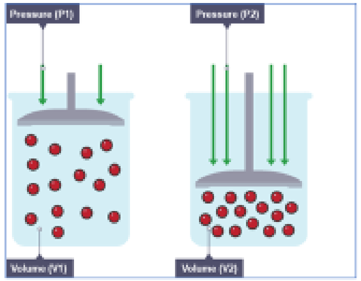
Gases want to remain at a constant temperature:-

- Increasing the pressure of the gas causes it to compress (have a smaller volume)
    - o Pressure increases, so greater force per area
    - o Same force is exerted on walls, as temperature and energy of particles is constant
    - o Force needs to be exerted on a smaller area and volume decreases
- Other way round?
    - o Volume increases, so a greater area that particles collide with
    - o Same force is exerted on the walls as velocity is constant (as velocity is only affected by temperature) and pressure decreases

- So this means pressure ∝ 1 / volume (inversely proportional)

For a gas at fixed mass and temperature: P1V1 = P2V2

Where P is pressure and V is volume in states 1 and 2.



Doing Work on a Gas (Physics Only):-

- Doing work on a gas increases its temperature

WD = Force × distance = Force / Area × (area × distance) = Pressure × Volume

work done = pressure × volume

Adding More Particles to A Fixed Volume (Physics Only):-

o Doing work on a gas means compressing or expanding the gas, so changing the volume
o Pumping more gas into the same volume means more particles are present, so more collisions occur per unit time with the walls, so pressure increases.
o Energy is transferred to the particles when more gas is added into the fixed volume, so this heats the gas

A Fixed Number of Particles with A Decreasing Volume (Physics only):-

o The particles collide with the wall which is moving inward
o So the particles gain momentum, as the rebound velocity is greater than the approaching velocity
o So as the particle has a greater velocity, the pressure increases as the particles collide with the walls more frequently (time between collisions decreases)
o And the temperature also increases, as the kinetic energy of each particle increases

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
https://www.climate.gov/news-features/understanding-climate/climate-change-ocean-heat-content	Egg/hot water/conical flask demo: Ask students to suggest why egg goes into flask as water cools - what happens, in terms of the difference in air pressure between the inside and outside the flask	*Core Practical: Investigate the properties of water by determining the specific heat capacity of water and obtaining a temperature-time graph for melting ice*	*P14.3: Core practical: Investigate the densities of solid and liquids*	Heating Engineer, Product Design, Aeronautical Engineering, Environmental Scientist; Thermal Physics

CULTURAL CAPITAL: Understanding the link between Specific Heat Capacity, Global warming and rising sea-levels (Impressive Reading)

SEND

- Opening activity/theme is … to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge via Knowledge Recall slide
- Multi-sensory approach using video, practical work, teacher explanation/modelling, paired work
- Global warming and rising ocean temperature case study chosen to support cultural capital
- Global warming and rising ocean temperature case study chosen as relatable
- Global warming and rising ocean temperature case study chosen due to cross curricular links with Geography supporting non-verbal reasoning
- Technology: video used to support accessibility
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning

Topic: KS4: Magnetism & the Motor Effect	Duration: 5 Lessons	Composite: Unit test

Key vocabulary:

Pole
Magnetic Field
Force
Permanent
Induced
Domain
Earth
Current
Uniform
Magnetic flux density
Tesla
Solenoid
Motor

Core knowledge Components

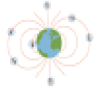
Powerful knowledge components crucial to commit to long term memory (IN RED BOX)

KS4 MAGNETISM & MOTOR EFFECT KNOWLEDGE ORGANISER

POWERFUL KNOWLEDGE
- **Magnets have a North pole and South pole.**
- **Like poles repel; opposite poles attract.**
- **Iron, nickel, cobalt and steel are magnetic materials.**
- **Magnetic materials feel a force in the region around a magnet called a magnetic field.**
- **Magnetic field lines show the pattern and direction of the magnetic field.**

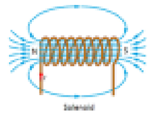
- **Permanent magnets**: always magnetic; always have poles. Uses – speakers, compasses and electric generators.

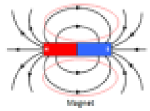
Earth' Core:-
- Magnetic – creates large magnetic field around Earth
- We know this because a freely suspended magnetic compass will align itself with the Earth's field lines & point North
- A compass is effectively a suspended Bar Magnet, with its own North pole lining up with Earth's North pole:-
  - This cannot be right - like poles repel
  - So in fact, Earth's magnetic pole in the north is a magnetic South Pole and the geographic south pole is close to the magnetic North Pole



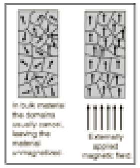
The magnetic field lines around a **straight current-carrying wire:-**
- Current produces a magnetic field around a wire
- The direction is dictated by the "right hand rule"
- Plotting compasses on a piece of paper through which a wire is pierced shows this
- Current direction is perpendicular to the magnetic field direction
- Magnetic field strength depends on current size; Greater current, stronger magnetic field

The magnetic field lines around a coil of wire (also called a solenoid):-
- Magnetic Field Shape is similar to a bar magnet
- Coiling the wire causes the field to align and form a giant single, almost uniform field along the centre of the Solenoid.
- Having an iron core in the centre increases its strength as it is easier for magnetic field lines to pass through than air
- The fields from individual coils cancel inside to produce a weaker field outside the solenoid
- Factors that affect strength of field: Size of current; Length; Cross sectional area; Number of turns (coils); Using a soft iron core



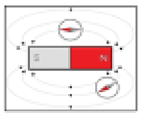


- **Induced magnets:-**
  - 'magnetic' but no fixed poles
  - Induced = temporary magnetism 'made to happen'
  - Made by stroking with a permanent magnet which aligns domains in the same direction
  - After time, or a knock, domains move into random positions so magnetism lost.

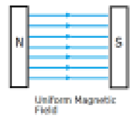


Magnetic Fields
- Magnets create magnetic fields.
- Field Lines point North to South at any point.
- Field strength decreases with distance from the magnet
- They fill the space around a magnet where the magnetic forces work, and where they can attract or repel magnetic materials.
- We can detect them using **iron filings**. The tiny pieces of iron line up in a magnetic field.

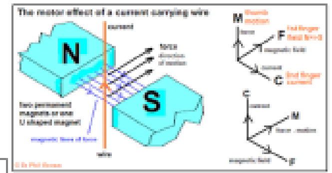
Plotting Magnetic Field Lines for a Bar Magnet
- Magnetic fields can be mapped out using small plotting compasses:
- Place the plotting compass near the magnet on a piece of paper.
- Mark the direction the compass needle points.
- Move the plotting compass to many different positions in the magnetic field, marking the needle direction each time.
- Join the points to show the field lines.



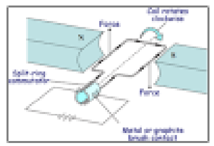
Uniform Magnetic Field:-
- Between 2 magnets that interact
- Closer lines = stronger field
- Uniform = field is same strength at any point as lines have the same distance between them



- A wire carrying a current creates a **magnetic field.**
- This can interact with another magnetic field, causing a force that pushes the wire at right angles.
- This is called the **motor effect**.
- Force = magnetic flux density x current x length (F = B x I x l)
  (Newtons, N) (Tesla, T) (Amps, A) (metres, m)



Motors
- A coil of wire in between two permanent magnets
- Current flows through the wire, and the magnetic field it produces interacts with the magnets
- One side of the coil gets forced down, the other side gets forced up
- This causes the coil to rotate o Use the Left Hand Rule to verify which side moves up or down



Links to previous and future topics

Y7: Electricity

Y8: Magnetism

KS4: Conservation of Energy; Forces & their Effects; Electromagnetism

KS5: Magnetic Fields; Electric Fields

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
https://www.nhs.uk/conditions/mri-scan/ https://newcastleclinic.co.uk/honouring-inventor-mri-scanner/	Explain how an MRI scan works	Explain how an MRI scan works	Construction of magnetic field diagrams	Medical imaging/ Radiographer in hospitals (MRI), Electrical Power Technician, Geomagnetist, Chemical Physicist, Robotics Engineer, Magnet Engineer

CULTURAL CAPITAL: Peter Mansfield (who couldn't do Science allegedly!), the MRI scanner and a Nobel Prize.

SEND

- Opportunities for retrieval practice and building on prior knowledge – Knowledge Recall Starter slide each lesson
- Multi-sensory approach using video, watching teacher demonstrations/modelling, tactile activities, practical work, team/paired work
- Additional curriculum time allocated to after school revision sessions.
- MRI/Peter Mansfield case study chosen to support cultural capital at KS4/KS5
- MRI/Peter Mansfield case study chosen as relatable
- MRI/Peter Mansfield case study chosen that are life skills or work-related to support the pathway into adulthood
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning
- Texts used/alternative texts available with a consideration to reading age
- Activities are scaffolded with over-learning of previous content to encourage independence