| Topic: KS4: Magnetism & the Motor Effect | Duration: 5 Lessons | Composite: Unit test |
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| Key vocabulary: | Core knowledge Components<br>Powerful knowledge components crucial to commit to long term memory (IN RED BOX) | Links to previous and future topics |
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| Pole<br>Magnetic<br>Field<br>Force<br>Permanent<br>Induced<br>Domain<br>Earth<br>Current<br>Uniform<br>Magnetic flux density<br>Tesla<br>Solenoid<br>Motor | KS4 MAGNETISM & MOTOR EFFECT KNOWLEDGE ORGANISER<br><br>**POWERFUL KNOWLEDGE**<br>• **Magnets have a North pole and South pole.**<br>• **Like poles repel; opposite poles attract.**<br>• **Iron, nickel, cobalt and steel are magnetic materials.**<br>• **Magnetic materials feel a force in the region around a magnet called a magnetic field.**<br>• **Magnetic field lines show the pattern and direction of the magnetic field.**<br><br>• **Permanent magnets**: always magnetic; always have poles. Uses – speakers, compasses and electric generators.<br><br>**Earth' Core:-**<br>• Magnetic – creates large magnetic field around Earth<br>• We know this because a freely suspended magnetic compass will align itself with the Earth's field lines & point North<br>• A compass is effectively a suspended Bar Magnet, with its own North pole lining up with Earth's North pole:-<br>o This cannot be right - like poles repel<br>o 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<br><br>The magnetic field lines around a **straight current-carrying wire:-**<br>• Current produces a magnetic field around a wire<br>• The direction is dictated by the "right hand rule"<br>• Plotting compasses on a piece of paper through which a wire is pierced shows this<br>• Current direction is perpendicular to the magnetic field direction<br>• Magnetic field strength depends on current size; Greater current, stronger magnetic field<br><br>**The magnetic field lines around a coil of wire (also called a solenoid):-**<br>• Magnetic Field Shape is similar to a bar magnet<br>• Coiling the wire causes the field to align and form a giant single, almost uniform field along the centre of the Solenoid.<br>• Having an iron core in the centre increases its strength as it is easier for magnetic field lines to pass through than air<br>• The fields from individual coils cancel inside to produce a weaker field outside the solenoid<br>• Factors that affect strength of field: Size of current; Length; Cross sectional area; Number of turns (coils); Using a soft iron core<br><br>**Induced magnets:-**<br>o 'magnetic' but no fixed poles<br>o Induced = temporary magnetism 'made to happen'<br>o Made by stroking with a permanent magnet which aligns domains in the same direction<br>o After time, or a knock, domains move into random positions so magnetism lost.<br><br>**Magnetic Fields**<br>• Magnets create magnetic fields.<br>• Field Lines point North to South at any point.<br>• Field strength decreases with distance from the magnet<br>• They fill the space around a magnet where the magnetic forces work, and where they can attract or repel magnetic materials.<br>• We can detect them using **iron filings**. The tiny pieces of iron line up in a magnetic field.<br><br>**Plotting Magnetic Field Lines for a Bar Magnet**<br>• Magnetic fields can be mapped out using small plotting compasses:<br>• Place the plotting compass near the magnet on a piece of paper.<br>• Mark the direction the compass needle points.<br>• Move the plotting compass to many different positions in the magnetic field, marking the needle direction each time.<br>• Join the points to show the field lines.<br><br>**Uniform Magnetic Field:-**<br>• Between 2 magnets that interact<br>• Closer lines = stronger field<br>• Uniform = field is same strength at any point as lines have the same distance between them<br><br>• A wire carrying a current creates a **magnetic field**.<br>• This can interact with another magnetic field, causing a force that pushes the wire at right angles.<br>• This is called the **motor effect**.<br>• Force = magnetic flux density x current x length ( F = B x I x l)<br>(Newtons, N) (Tesla, T) (Amps, A) (metres, m)<br><br>**Motors**<br>• A coil of wire in between two permanent magnets<br>• Current flows through the wire, and the magnetic field it produces interacts with the magnets<br>• One side of the coil gets forced down, the other side gets forced up<br>• This causes the coil to rotate o Use the Left Hand Rule to verify which side moves up or down | Y7: Electricity<br><br>Y8: Magnetism<br><br>KS4: Conservation of Energy; Forces & their Effects; Electromagnetism<br><br>KS5: Magnetic Fields; Electric Fields |

| Impressive reading | Impressive speaking | Impressive writing | Resilience | Employability via: |
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| https://www.nhs.uk/conditions/mri-scan/<br><br>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