Physics Scheme of Learning

P15: Electromagnetism

Intent – Rationale P15 is the final topic for combined students and the penultimate topic for triple award students. It is a key opportunity to apply some mathematical skills to some challenging situations involve using two equations, with the transformer this is an opportunity to practise linking equations together.

Magnets form a key part of everyday life, and modern life would not be the same without them. Learning about generator to produce electricity, motors to produce movement and a ramicrophones and maglev trains allow students to see Physics in a real world context.

There is also scope for a range of practical skills development through extensive practical work.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning o
Topic 2 Phys Forces and Effects Topic 5 Phys Magnets and Electromagnets GCSE P5 Electricity in the home	A level – Year 13 topic electromagnetism
What are the links with other subjects in the curriculum?	What are the links to SMSC, British
 Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work 	P15.3 Electromagnets in Devices SP3 P15.4 The Motor Effect GB4e
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	What are the opportunities for developi
	 The use of several equations with transformer calculation The use of ratios with transformers turns calculations.



s. Five mark calculation questions often
ange of other applications such as speakers,
oes this topic feed into?
alues and Careers?
ng mathematical skills?
s.

Physics Scheme of Learning

P15: Electromagnetism

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic? Know Use the 'right hand thumb rule' to draw the magnetic field pattern of a wire carrying a current and for a solenoid. Draw the magnetic field pattern for a straight wire carrying a current and for a solenoid. Draw the magnetic field pattern of a bar magnet and describe how to plot the magnetic field pattern using a compass. Describe how to distinguish between a magnetic material and a magnet by experiment. Describe how to distinguish between a magneti and how this is shown by the magnetic field pattern. Describe how a step-up transformer and a step-down transformer affect the potential difference on the secondary coil compared to the primary coil. Calculate the current drawn from the input supply to provide a particular power output. V_S x i_5 = V_D x i_0 Use simple ratios or the equation to calculate any unknown value. V_p/V_s = n_p/n_s Describe how to magnet idleference, and induced current, of reversing the direction of motion of the conductor in a magnetic field. Describe how to magnet as a simple d.c. generator from wire and permanent magnets. Use and apply the equation: I = 8 I to calculate any mismic yalue when given other values. Describe how the magnetic field of changing the direction of the electric current. Describe how to magnet as and be domonstrated. Describe how enalle difference, a		
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Explain how a moving-coil loudspeaker and headphones work	Explain how a moving-coil microphone works	
	Explain how a moving-coil loudspeaker and headphones work	
Explain what is meant by the motor effect.	Explain what is meant by the motor effect.	
Explain why a motor spins with respect to the magnetic field produced by a wire carrying an electric current and the magnetic field of the permanent magnets in the mot	Explain why a motor spins with respect to the magnetic field produced by a wire carrying an electric current and the n	nagnetic field of the permanent magnets in the mot
Perform calculations to determine the potential difference on the primary or secondary coil or the number of turns on the primary or secondary coil when given the other	Perform calculations to determine the potential difference on the primary or secondary coil or the number of turns or	the primary or secondary coil when given the othe
Explain how a step-up transformer will increase the potential difference in the secondary coil compared to the primary coil but it will also decrease the current	Explain how a step-up transformer will increase the potential difference in the secondary coil compared to the primar	y coil but it will also decrease the current

Explain the reason why in the National Grid system the p.d. across the power cables is increased only to decrease at the other side of the cables.

Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.



tor interacting. er values.

What subject specific language will be used and developed in this topic?	What opportunities are available for assessing
alternator	Completion of a P15 end of topic test
an alternating current generator	
dynamo	P15.3 Electromagnets in Devices - Answering of past exam que
a direct-current generator	
electromagnet	P15 7 Transformers - Answering of past exam questions throw
an insulated wire wrapped round an iron bar that becomes magnetic when there is a current in the wire	
electromagnetic induction	P15.8 Transformers in Action - Assessment of calculations three
the process of inducing a potential difference in a wire by moving the wire so it cuts across the lines of force of a magnetic field	transformers - https://isaacphysics.org/assignment/7dd5a936
Fleming's left-hand rule	
a rule that gives the direction of the force on a current-carrying wire in a magnetic field according to the directions of the current and the field	
generator effect	
the production of a potential difference using a magnetic field	
induced magnetism	
magnetism of an unmagnetised magnetic material by placing it in a magnetic field	
magnetic field	
the space around a magnet or a current-carrying wire	
magnetic field line	
line in a magnetic field along which a magnetic compass points – also called a line of force	
magnetic flux density	
a measure of the strength of the magnetic field defined in terms of the force on a current-carrying conductor at right angles to the field lines	
motor effect	
when a current is passed along a wire in a magnetic field, and the wire is not parallel to the lines of the magnetic field, a force is exerted on the wire by the magnetic field	
solenoid	
a long coil of wire that produces a magnetic field in and around the coil when there is a current in the coil	
split-ring commutator	
metal contacts on the coil of a direct current motor that connects the rotating coil continuously to its electric power supply	
step-down transformer	
electrical device that is used to step-down the size of an alternating potential difference	
step-up transformer	
electrical device that is used to step-up the size of an alternating potential difference	
transformer	
electrical device used to change an (alternating) voltage. See also step-up transformer and step-down transformer	



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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	
P15.1 Magnetic Fields	Can I describe how to distinguish between a magnetic material and a magnet by experiment? Can I describe where the strongest point of a magnet is and how this is shown by the magnetic field pattern? Can I describe how the strength of the magnet varies with distance from the magnet? Can I draw the magnetic field pattern of a bar magnet and describe how to plot the magnetic field pattern using a compass?	Can I explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic?	
P15.2 Magnetic Fields and Electric Currents	Can I describe how the magnetic effect of a current can be demonstrated? Can I use the 'right hand thumb rule' to draw the magnetic field pattern of a wire carrying an electric current? Can I draw the magnetic field pattern for a straight wire carrying a current and for a solenoid? Can I describe the effect on the magnetic field of changing the direction of the electric current? Describe ways of increasing the magnetic field strength of a solenoid?	Can I explain how an electromagnet can be made from a solenoid?	
P15.3 Electromagnets in Devices	Can I describe how an electric bell and EM relay works?	Can I explain how a moving-coil loudspeaker and headphones work? Can I explain how a moving-coil microphone works?	
P15.4 The Motor Effect	Can I use and apply the equation $:F = B I L$ to calculate any missing value when given other values?	Can I explain what is meant by the motor effect? Can I explain why a motor spins with respect to the magnetic field produced by a wire carrying an electric current and the magnetic field of the permanent magnets in the motor interacting?	
P15.5 The Generator Effect	Can I describe what a generator does? Can I describe the effect on the induced potential difference, and induced current, of reversing the direction of motion of the conductor in a magnetic field?	Can I describe the effect on the induced potential difference, and induced current, of reversing the polarity of the magnets in a generator?	
P15.5& The AC & DC Generator	Can I describe how to make a simple d.c. generator from wire and permanent magnets? Can I draw and label both a.c. and d.c. generators? What determines whether the output current of a generator is a.c. or d.c.? Can I draw/interpret graphs of potential difference generated in the coil against time?	Can I explain how an alternator generates a.c. and a dynamo generates d.c?	
P15.7 Transformers	Can I describe how a step-up transformer and a step- down transformer affect the potential difference on the secondary coil compared to the primary coil?	Can I explain why transformers used?	



Suggested activities and resources		

		Can I explain the reason why in the National Grid system the p.d. across the power cables is increased only to decrease at the other side of the cables?	
P15.8 Transformers in Action	Can I calculate the current drawn from the input supply to provide a particular power output? $V_S \ x \ I_s = V_p \ x \ I_p$ Can I perform calculations to determine the potential difference on the primary or secondary coil or the number of turns on the primary or secondary coil when given the other values.? Can I use simple ratios or the equation to calculate any unknown value. $\frac{V_p}{V_s} = \frac{n_p}{n_s}$?	Can I explain how a step-up transformer will increase the potential difference in the secondary coil compared to the primary coil but it will also decrease the current?	

