AQA Physics GCSE Student Progress

Unit 4.7 - Magnetism and Electromagnetism

4.7.1. Permanent and Induced Magnetism, Magnetic Forces and Fields

4.7.1.1. Poles of a Magnet

a	I know that the poles of a magnet are the places where the magnetic forces are strongest.			
b	I know that when two magnets are brought close together they exert a force on each other; two like poles repel each other whereas two unlike poles attract each other.			
c	I know that attraction and repulsion between two magnetic poles are examples of non-contact force.			
d	I know that a permanent magnet produces its own magnetic field.			
e	I know that an induced magnet is a material that becomes a magnet when it is placed in a magnetic field and that induced magnetism always causes a force of attraction. When removed from the magnetic field an induced magnet loses most/all of its magnetism quickly.			
f	I can describe the difference between permanent and induced magnets.			

4.7.1.2. Magnetic Fields

a	I know that the region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel) is called the magnetic field.			
b	I know that the force between a magnet and a magnetic material is always one of attraction.			
c	I know that the strength of the magnetic field depends on the distance from the magnet. The field is strongest at the poles of the magnet.			
d	I know that the direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point.			
e	I know that the direction of a magnetic field line is from the north (seeking) pole of a magnet to the south (seeking) pole of the magnet.			
f	I know that a compass contains a small bar magnet and that the Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field.			
g	I can describe how to plot the magnetic field pattern of a magnet using a compass.			
h	I can draw the magnetic field pattern of a bar magnet showing how strength and direction change from one point to another.			
i	I can explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.			

4.7.2. The Motor Effect

4.7.2.1. Electromagnetism

a	I know that, when a current flows through a conducting wire, a magnetic field is produced around the wire and that the strength of the magnetic field depends on the current through the wire and the distance from the wire.			
b	I know that shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire. The magnetic field inside a solenoid is strong and uniform.			
c	I know that the magnetic field around a solenoid has a similar shape to that of a bar magnet.			
d	I know that that adding an iron core increases the strength of the magnetic field of a solenoid and that an electromagnet is a solenoid with an iron core.			
e	I can describe how the magnetic effect of a current can be demonstrated.			
f	I can draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field).			
g	I can explain how a solenoid arrangement can increase the magnetic effect of the current.			

4.7.2.2. Fleming's Left Hand Rule (HT Only)

a	I know that when a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other. This is called the motor effect.			
b	I can show that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field.			
c	I can recall the factors that affect the size of the force on the conductor.			
d	I can apply the following equation (given on the physics equation sheet) for a conductor at right angles to a magnetic field and carrying a current: force = magnetic flux density × current × length $F = B I l$ force, F, in newtons, (N) magnetic flux density, B, in tesla, (T) current, I, in amperes / amps, (A) length, l, in metres, (m)			

4.7.2.3. Electric Motors (HT Only)

a	I know that a coil of wire carrying a current in a magnetic field tends to rotate and that this is the basis of an electric motor.			
b	I can explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor.			

4.7.2.4. Loudspeakers (Physics Only) (HT Only)

a	I know that loudspeakers and headphones use the motor effect to convert variations in current in electrical circuits to the pressure variations in sound waves.			
b	I can explain how a moving-coil loudspeaker and headphones work.			

4.7.3. Induced Potential, Transformers and the National Grid (Physics Only) (HT Only)

4.7.3.1. Induced Potential (Physics Only) (HT Only)

a	I know that if an electrical conductor moves relative to a magnetic field or if there is a change in the magnetic field around a conductor, a potential difference is induced across the ends of the conductor and that if the conductor is part of a complete circuit, a current is induced in the conductor. This is called the generator effect.			
b	I know that an induced current generates a magnetic field that opposes the original change, either the movement of the conductor or the change in magnetic field.			
c	I can recall the factors that affect the size of the induced potential difference/ induced current.			
d	I can recall the factors that affect the direction of the induced potential difference/ induced current.			
e	I can apply the principles of the generator effect in a given context.			

4.7.3.2. Uses of the Generator Effect (Physics Only) (HT Only)

a	I know that the generator effect is used in an alternator to generate AC and in a dynamo to generate DC.			
b	I can explain how the generator effect is used in an alternator to generate AC.			
c	I can explain how the generator effect is used in a dynamo to generate DC.			
d	I can draw and interpret graphs of potential difference generated in the coil against time.			

4.7.3.3. Microphones (Physics Only) (HT Only)

a	I know that microphones use the generator effect to convert the pressure variations in sound waves into variations in current in electrical circuits.			
b	I can explain how a moving-coil microphone works.			

4.7.3.4. Transformers (Physics Only) (HT Only)

a	I know that a basic transformer consists of a primary coil and a secondary coil wound on an iron core and that iron is used as it is easily magnetised.			
b	I know that the ratio of the potential differences across the primary and secondary coils of a transformer Vp and Vs depends on the ratio of the number of turns on each coil, Np and Ns.			
c	I can apply the following equation (given on the physics equation sheet): $\frac{Vp}{Vs} = \frac{Np}{Ns}$			
d	I know that, in a step-up transformer Vs > Vp and that in a step-down transformer Vs < Vp.			
e	I know that, if transformers were 100 % efficient, the electrical power output would equal the electrical power input.			
f	I can apply the following equation (given on the physics equation sheet): $Vs \times Is = Vp \times Ip$ where $Vs \times Is$ is the power output, in Watts, W (secondary coil) and $Vp \times Ip$ is the power input, in Watts, W (primary coil).			
g	I can explain how the effect of an alternating current in one coil in inducing a current in another is used in transformers.			
h	I can explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each.			
i	I can calculate the current drawn from the input supply to provide a particular power output.			
j	I can apply the equation linking the pds and number of turns in the two coils of a transformer to the currents and the power transfer involved, and relate these to the advantages of power transmission at high potential differences.			