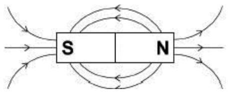
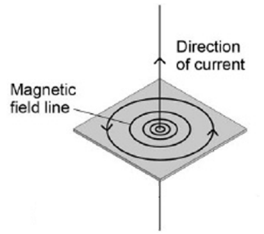
Meden School Curriculum Planning							
Subject	Physics	**Year Group**	11	**Sequence No.**	21	**Topic**	P7 Magnetism

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
Y7 Magnets A magnet has a north pole and a south pole. Opposite poles attract, like poles repel. You can identify a magnetic field using iron filings. A wire produces a magnetic current when a current flows through it. A piece of iron with a current carrying wire coiled around it is called an electromagnet. **Y9 Electromagnets** You can increase the strength of an electromagnet by increasing the number of coils or increasing the current. Electromagnets are used in bells, scrap yards and cars	**L1 Magnets and Magnetic Fields:** Magnets can produce an **attractive** or a **repulsive** force. Magnetic force is a **non-contact** force. The force between a magnet and a magnetic material is always one of attraction. **Iron, steel, cobalt** and **nickel** are examples of magnetic materials. The region around a magnet where a force acts on another magnet or on a magnetic material is called the **magnetic field**. The strength of the magnetic field depends on the **distance** from the magnet. The field is **strongest at the poles** of the magnet. 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. The direction of a magnetic field line is from the **north** (seeking) pole of a magnet **to the south** (seeking) pole of the magnet. You cannot see a magnetic field but it can be shown using iron filings. You can plot a magnetic field by using a plotting compass. The magnetic field around a bar magnet can be displayed like this:  A material that always generates a magnetic field is known as a **permanent magnet**. A material that only generates a magnetic field when in the magnetic field of a permanent magnet is known as an **induced magnet**. A magnetic compass contains a small bar magnet. The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field. The behaviour of a magnetic compass is related to evidence that the **core of the Earth** must be **magnetic**.	The magnetic field produced by the Earth periodic flips (approx. 100 times in a 20 million year period).

L2 Electromagnetism and The Right Hand Rule When a **current flows** through a conducting wire a **magnetic field** is produced around the wire. The strength of the magnetic field depends on the current through the wire and the distance from the wire. The magnetic effect of a current carrying wire can be demonstrated using a plotting compass. The direction of the magnetic field can be calculated using the **right hand thumb rule**. The magnetic field around a current carrying wire can be displayed as follows:



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**.

The magnetic field around a solenoid has a similar shape to that of a bar magnet. Adding an iron core increases the strength of the magnetic field of a solenoid. An **electromagnet** is a solenoid with an **iron core.**

Electromagnets can be used in scrap yards, car ignition systems, electric bells etc..

L3 The Motor Effect (HT only) 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**.

Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field. The thumb represents the direction of force (motion), the first finger represents the direction of magnetic field, the second finger represents the direction of current.

The magnitude of the forces increases with strength of magnetic field and also with the size of the current.

For a conductor at right angles to a magnetic field and carrying acurrent:

force = magnetic flux density × current × length

$F = B\,I\,l$

Where force, F is in Newtons, N; magnetic flux density, B is in Tesla, T; current, I is in amperes, A; length, l is in metres m

Currently the location of magnetic North is moving southwards by 30 miles a year, leading some scientists to think a magnetic flip is taking place. How might this affect powerlines, telecommunications, animal locations (e.g. salmon going back to breeding rivers) and protection from sun’s radiation.

	L4Using the Motor Effect (HT only) A coil of wire carrying a current in a magnetic field tends to **rotate**. This is the basis of an electric motor. The coil is on a spindle so rotates, a **split-ring communicator** swaps the current every half turn the keep the motor rotating in the same direction. The **direction** of the motor can by **reversed** by swapping the **polarity** of the current or swapping the poles of the magnetic field. The speed of a motor can be increased by increasing the current, adding more turns to the coil or increasing the magnetic density flux. **L5 The generator Effect** 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. If the conductor is part of a complete circuit, a current is induced in the conductor. This is called the generator effect. An induced current generates a magnetic field that opposes the original change, either the movement of the conductor or the change in magnetic field. The generator effect is used in an alternator to generate ac and in a dynamo to generate dc. Students should be able to: • explain how the generator effect is used in an alternator to generate ac and in a dynamo to generate dc • draw/interpret graphs of potential difference generated in the coil against time. **L6: Loudspeakers and Microphones** Loudspeakers and headphones use the motor effect to convert variations in current in electrical circuits to the pressure variations in sound waves. Students should be able to explain how a moving-coil loudspeaker and headphones work. Microphones use the generator effect to convert the pressure variations in sound waves into variations in current in electrical circuits. Students should be able to explain how a moving-coil microphone works. **L7: Transformers** A basic transformer consists of a primary coil and a secondary coil wound on an iron core. Iron is used as it is easily magnetised. The ratio of the potential differences across the primary and secondary coils of a transformer V_p and V_s depends on the ratio of the number of turns on each coil, n_p and n_s **L8 Transformer Calculations** $\frac{v_p}{v_s} = \frac{n_p}{n_s}$ potential difference, V_p and V_s in volts, V In a step-up transformer $V_s > V_p$ In a step-down transformer $V_s < V_p$ If transformers were 100% efficient, the electrical power output would equal the electrical power input.	

	$V_s \times I_s = V_p \times I_p$ Where $V_s \times I_s$ is the power output (secondary coil) and $V_p \times I_p$ is the power input (primary coil). power input and output, in watts, W Students should be able to: • explain how the effect of an alternating current in one coil in inducing a current in another is used in transformers • explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each • calculate the current drawn from the input supply to provide a particular power output apply the equation linking the p.d.s 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 **L9: Revision** **L10: End of Topic Test** **L11: GPA test feedback**	