Meden School Curriculum Planning							
Subject	Physics	**Year Group**	13	**Sequence No.**		**Topic**	Capacitance and Magnetic Fields

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!'
AS Electricity topic	**3.7.4 Capacitance** **3.7.4.1 Capacitance** OBJ Definition of capacitance: $C = \frac{Q}{v}$ **3.7.4.2 Parallel plate capacitor** Dielectric action in a capacitor *C* = Relative permittivity and dielectric constant. The action of a simple polar molecule that rotates in the presence of an electric field. Investigate the relationship between *C* and the dimensions of a parallel-plate capacitor eg using a capacitance meter. **3.7.4.3 Energy stored by a capacitor**	

	Interpretation of the area under a graph of charge against pd. Use the following equations $E = 0.5QV = 0.5CV^2 = 0.5Q/C^2$ **3.7.4.3 Capacitor charge and discharge** Graphical representation of charging and discharging of capacitors through resistors. Corresponding graphs for *Q*, *V* and *I* against time for charging and discharging. Interpretation of gradients and areas under graphs where appropriate. Time constant *RC*. Calculation of time constants including their determination from graphical data. Time to halve, $T_{½} = 0.69RC$ Quantitative treatment of capacitor discharge, $Q = Q_0 e^{-t/RC}$ Use of the corresponding equations for *V* and *I*. Quantitative treatment of capacitor charge, $Q = Q_0 (1 - e^{-t/RC})$ **Required practical 9:** Investigation of the charge and discharge of capacitors. Analysis techniques should include log-linear plotting leading to a determination of the time constant, *RC* **3.7.5.Magnetic fields**	A fan is an example of the daily use of gadgets and devices that make use of capacitors for their basic operation. Here, a capacitor typically aids at initiating the rotatory motion of the fan blades and is also responsible to sustain the spinning motion of the moving blades. For this purpose, the capacitor generates the necessary magnetic flux required to produce an adequate magnitude of torque force. Capacitors also come in handy in cases of emergency shutdowns. For instance, some of the emergency shutdown systems designed for computers contain an internal electronic circuit that is embedded with an array of capacitors on the output side. The main advantage of using such systems is the high reliability and minimum requirement

GCSE P7 Magnets and Electromagnetism, including F=BIL and Flemings Left Hand Rule	**3.7.5.1 Magnetic flux density** Force on a current-carrying wire in a magnetic field: $F = BIl$ when field is perpendicular to current. Fleming's left hand rule. Magnetic flux density B and definition of the tesla. **Required practical 10:** Investigate how the force on a wire varies with flux density, current and length of wire using a top pan balance. **3.7.5.2 Moving charges in a magnetic field** Force on charged particles moving in a magnetic field, $F = BQv$ when the field is perpendicular to velocity. Direction of force on positive and negative charged particles. Circular path of particles; application in devices such as the cyclotron. **3.7.5.3 Magnetic flux and flux linkage** Magnetic flux defined by $\Phi = BA$ where B is normal to A. Flux linkage as $N\Phi$ where N is the number of turns cutting the flux. Flux and flux linkage passing through a rectangular coil rotated in a magnetic field: flux linkage $N\Phi = BAN \cos\theta$ **Required practical 11:** Investigate, using a search coil and oscilloscope, the effect on magnetic flux linkage of varying the angle between a search coil and magnetic field direction **3.7.5.4 Electromagnetic induction**	of additional charging circuitry. This is because the capacitors get charged automatically when the device is turned on. Computer data storage data are stored in hard disk drives on the basis of magnetism. There's a coating of magnetic material on the disc; consisting of billions or even trillions of tiny magnets. With the use of an electromagnetic head, data is stored in the disc. Microwave ovens also work with the help of the magnetic force. They use a device called a magnetron to generate the power for cooking. A magnetron is a vacuum tube designed to cause electrons to circulate in a loop inside the tube. A magnet is placed around the tube to provide the magnetic force that causes the electrons to move in a loop

	Simple experimental phenomena. Faraday's and Lenz's laws. Magnitude of induced emf = rate of change of flux linkage $\varepsilon = N \frac{\Delta \Phi}{\Delta t}$ Applications such as a straight conductor moving in a magnetic field. emf induced in a coil rotating uniformly in a magnetic field: $\varepsilon = BAN \omega \sin \omega t$ **3.7.5.5 Alternating currents** Sinusoidal voltages and currents only; root mean square, peak and peak-to-peak values for sinusoidal waveforms only. $I_{rms} = \frac{I_0}{\sqrt{2}}$; $V_{rms} = \frac{V_0}{\sqrt{2}}$ Application to the calculation of mains electricity peak and peak-to-peak voltage values. Use of an oscilloscope as a dc and ac voltmeter, to measure time intervals and frequencies, and to display ac waveforms. **3.7.5.6 The operation of a transformer** The transformer equation: $\frac{N_s}{N_p} = \frac{V_s}{V_p}$ Transformer efficiency = $\frac{I_S V_S}{I_P V_P}$ Production of eddy currents. Causes of inefficiencies in a transformer.	All chargers for phones, ipads etc need to include transformers which not only convert AC to DC but need to drop the voltage from 230V to about 6V Charger plugs get warm even if not connected to the device which means they are drawing electricity and converting the energy into wasted thermal. This means chargers left plugged in are costing money on your electricity bill

	Transmission of electrical power at high voltage including calculations of power loss in transmission lines.	