Meden School Curriculum Planning							
Subject	Physics	**Year Group**	9	**Sequence No.**	9	**Topic**	Electricity & Resistance

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!'
KS3 Y7 (Simple Circuits): Electricity is the mechanism that transfers energy. Mains or batteries. Electrons flow around wires, this is called current. Conventional current moves from the positive to the negative end of the battery. Current is measured in Amps or A for short and are named after Andre-Marie Ampere. Drawing circuits in that the wires are drawn with a pencil and ruler and how to draw circuit components such as a bulb which is a X inside a circle. A series circuit is all in one loop and does not have branches. A parallel circuit has branches. Current divides down the branches in a parallel circuit. Metal wires are conductors and the plastic coatings are insulators. In a plug the live wire is brown, the blue wire is neutral and the green/yellow stripy wire is an earth wire.	**L1: Series:** the current flows in **one complete** circuit. **Parallel: more than one pathway** for the current to flow through. The **flow of electrons** is known as **current.** Electrons carry **energy** and pass it to components in the circuit. The unit for current is **amps** and the symbol is **A.** Current is measured using an **ammeter** connected in **series.** Current **branches in a parallel circuit** and **adds up** to the current leaving the **battery.** If a bulb blew in a series circuit so would the other one because current cannot flow through the **broken pathway.** If a bulb blew in a parallel circuit the other bulb would stay lit as it has its **own pathway** that current can flow through. **L2: Voltage** is the 'driving force' that is **pushes current** around a circuit. This is known as **potential difference** or **PD** for short. PD is measured in **volts (V)** using a **voltmeter.** It is represented by a **circle with a capital V** in it. Voltmeters are joined to a circuit in **parallel,** never series because it measures the 'driving force' needed to push current through that circuit component. A **battery is made of two or more cells.** **L3:** PD **decreases** when more bulbs are added in series, brightness of bulbs **decreases** as more bulbs are added to the circuit, **lower PD = less bright.** In a **series** circuit, the PD supplied by the battery is **shared** by the components. So, the **sum** of the **PD** across the **components equals** the **battery PD**. **L4: Resistance** is how much a material **reduces** the **flow of electrons**. Some materials have more resistance than others. **Insulators** have **very high resistance**. Ohm's law states that the **PD across a component** is **directly proportional to the current** flowing through it**. I = V/R**. I= current, V= PD and R = resistance which is measured in **Ohms.** **L5:** Current is the flow of **electrons**. Anything that makes it harder for the electrons to travel increases the **resistance**. Metals are made from **tightly packed ions**, the electrons have to **squeeze** passed the ions. Electrons **collide** with the ions, **more collision** means **higher resistance. Length, cross-sectional area, material** and **temperature** all affect resistance. **Longer** means that there are **more ions** that the **electrons** have to **squeeze past,** this results in more collisions and so a **higher resistance.** Wider means	

	more room for the **electrons to travel** through the wire, so this **decreases resistance.** More **conductive** materials are easier for electrons to travel through and so **lowers the resistance.** Metal ions **move more** due to an increase in **thermal energy.** If the metal ions are moving more, electrons are **more likely** to **collide** with them. So hotter means more collisions which means a **higher resistance.** Investigate the length of a wire in relation to resistance. Applying **CIDER**, where C stands for **Control variables** (all the things being **kept the same**). I stands for **Independent variable** (the **one thing being changed**). D stands for **Dependent variable** (the thing that is being **measured**). E stands for **Equipment**. R stands for **Risk assessment.** L6 (GPA): Complete length of the wire on resistance practical. Calculate R by using **R= V/I.** Draw a line graph of **length of wire (cm) over resistance (Ohms).** L7: Know how to draw the unusual symbols for: **diode, LDR (light dependent resistor), fuse, resistor, thermistor, LED (light emitting diode)** and **variable resistor**. The term **'I-V characteristics'** refers to a graph which shows how the **current (I)** flowing through a component changes as the **PD (V) across it is increased. Linear** components have an I-V characteristic that's a **straight line** (e.g. fixed resistor). **Non-linear** components have a **curved** I-V characteristic (e.g. bulb or diode). In an **ohmic conductor** current is **directly proportional** to PD so the graph is a **straight line** with a **positive gradient.** In a **filament lamp temperature increases** as **current increases** so **resistance increases** and the graph is **S shaped.** In a diode current only flows in **one direction** as **resistance** is very high in the **opposite direction**. An LDR is dependent on **intensity of light.** In **bright light resistant falls**, in **darkness resistance is highest**, they are used for automatic **night lights, outdoor lighting** and **burglar alarms**. A thermistor is **a temperature dependent resistor.** In **hot conditions the resistance drops**, in **cold conditions the resistance goes up. Car engine temperature sensors** and **electronic thermostats** are all examples of thermistors. **L8:** An **alternating PD** is **constantly changing** and it produces an **alternating current (ac),** so the flow of charge is constantly changing direction. **UK mains supply** is **230V.** The **frequency of ac is 50Hz.** Dc is **Direct current,** current that is always flowing in the **same direction** and it is created by a direct PD. In a plug **neutral (blue)** and **earth (green and yellow stripes)** wire carry **0V.** Neutral completes the circuit. Earth stops the appliance becoming live and so is a safety wire. **Live (brown)** provides the alternating PD and carries 230V. A PD is between a body and a live wire, **touching** it will cause a **current to flow** through the body. The live wire still has a PD of **230V** even when **turned off.** An **electrical fire** is caused by a connection between the live and the earth wire which causes a **huge current to flow**. L9: The Engineering sector employs **5.7 million** people which is just over **19%** of all employed people in the UK. **Electrician: fit, service and fix electrical machinery, circuits, machinery** and **wiring.** They usually work alone, but can work as a larger team for substantial projects. The work environment varies but can include construction sites, offices, client's homes or on the streets. An electrician may set up their own business, work for a company or train others. **£18,000 to £42,000** depending on experience. Need a **Level**	

	2 or 3 Diploma in Electrical Installation from a College. **Four or five GCSEs at grade 9 to 4** to start the **Level 3** course. **Two or more GCSEs at grade 9 to 3** for a **Level 2 course**. Alternatively, can do an **Electrician's Apprenticeship** or train as one if you join the **Armed Forces.** **Electronic Engineer: design** and **develop components** and **systems** for **industry** from **mobile communications** to **manufacturing** to **aerospace.** They prepare technical plans using computer-aided design (CAD) and design software. Estimating manufacture, labour costs and project timescales. They usually work for a company in a team of people. **£21,000 to £65,000** depending on experience. An **Honours degree** in any of the following: computer science, maths or nanotechnology can lead to a job as an electronic engineer. **Honours degrees take three years** to complete. **Two or three A-Levels** are required to get onto an Honours degree course. Alternatively, a **Level 4 or 5 Higher National Diploma in Electrical and Electronics Engineering** can be completed. To get onto this course **1 or 2 A-Levels are required**. Or there are **apprenticeships** available which require **four to five GCSEs at grade 9 to 4**. **Auto Electrician**: **fits, services** and **repairs the electrics in motor vehicles**. They also diagnose electrical faults and replace components. They will use specialised equipment to identify faults. Auto electricians will often work in a car garage as part of a company or set up their own business. **£15,000 to £35,000** depending on experience. A **Level 1 Award in Vehicle Motor Studies** or a **Level 2 Diploma in Auto Electrical and Mobile Electrical Competence. Two GCSE grades at 3-1** are needed for a **Level 1. Two or more GCSE grades at 9-3** are required for a **Level 2.** An **apprenticeship** is also available which require **GCSE English** and **Maths**. You may also need a **UK driving license.** **L10: Andre Marie Ampere** was born in Lyon, France in 1775 and died in 1836. He was a major figure in both mathematics and physics. This French scientist is credited with some of the earliest work in **electromagnetics.** Ampere started his adult life as a maths teacher but quickly rose in position and became a highly respected professor of mathematics, astronomy, and philosophy before being offered the chair of **experimental physics** at the College de France in 1824. In the 1820s, Ampere began research on **electrical currents** and the resulting behaviour of metals and wires. He demonstrated that two wires would either **attract** or **repel** each other, depending on whether their currents were traveling in the **same** direction or **opposite** directions. This discovery laid out the whole basis for electromagnetics. Ampere was considered one of the top researchers in experimental physics in his day. In his honour, the **ampere** became a **standard unit** of electrical measurement of current in 1881, forty-five years after his death. **Alessandro Volta** was born in Como, Italy in 1745 and died in 1827. He was an Italian scientist and physicist who is best known for his invention of the **battery.** Volta became a professor at the University of Pavia in 1778, chairing the **experimental physics** department for the next forty years. In collaboration with **Galvani** (of galvanized steel), Volta experimented on conducting a current between two different metals by running the **current** through a frog's leg. He later experimented with saltwater-soaked paper in	

	place of the animal's leg as a means of conductivity, and from these experiments Volta when on to develop the **voltaic pile** which evolved into the first **chemical battery.** This battery is remembered in scientific history as the first **electrochemical cell.** In recognition of Alessandro Volta's contributions to science, the **unit** of **electric potential** is called the **volt.** **Georg Ohm** was born in Bavaria, Germany in 1785 and died in 1854. He is best known for his **"Ohm's Law**", which states that the current flow through a conductor is **directly proportional to the potential difference** and **inversely proportional to the resistance**. Ohm carried out most of his research using **Volta's** newly invented **electrochemical cells.** In 1827 Ohm published **'The Galvanic Circuit Investigated Mathematically'** which contained the first publication of Ohm's Law. His work was not well received by his school and he resigned his position. In 1833 he applied for and received a post at the Polytechnic School of Nuremberg. He left in 1852 to take the position of professor of experimental physics at the University of Munich. While his work was not well received for some years, its importance was eventually recognized and he received the **Copley Medal** in 1841. The physical unit of **electrical resistance,** the **Ohm (symbol: Ω),** was named after him. **L11:** Revision **L12:** End of Topic Test	