**Learning Journey**

**P7- Magnets and Electromagnets**

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| 1 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | Magnetic materials are **Iron** (**Steel**), **Nickel** and **Cobalt**, or their **alloys**.  The region around a magnet where a force acts on another magnet or on a magnetic material is called the **magnetic field** this is strongest at the **poles**; **North** (field leaves) and **South**.  Magnets exert a **non-contact Force** on each other; **like poles repel**, **opposite poles attract**.  A **permanent magnet** produces its own magnetic field and is able to **attract and repel**.  An **induced magnet** is a material that becomes a magnet when placed in a magnetic field of a permanent magnet, it quickly loses its **magnetism** when removed from a magnetic field (only attracts)  A **compass** contains a small bar magnet which **aligns** itself with the magnetic field of the Earth (which is a giant magnet). |
| 2 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | When a **current** flows through a **conducting** wire a circular **magnetic field** is produced around the wire the direction is dependent on the current.  The **right hand thumb rule** can be used to work out the direction of the field, **thumb = current**, **fingers = field**.  A **solenoid** is a coil of wire which concentrates the magnetic field into a similar shape to a **bar magnet**.  Magnetism can be made stronger by:  Adding an **iron core** (now an **Electromagnet**)  Increasing the **voltage/current**  Increasing the number of **coils**. |
| 3 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | **When a current-carrying wire is placed in the magnetic field of a permanent magnet the magnet producing the field and the conducting wire exert a force on each other.**  This is called the **motor effect.**  Motors move due to the **interaction** of the magnetic fields from the magnet and the current-carrying wire.  **Fleming’s left hand rule** can be used to work out the direction of the current (second finger), magnetic field (first finger) or movement (thumb) - rotation. |
| 4 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | **Loudspeakers** and **headphones** use the **motor effect** to convert variations in **current** in electrical circuits to **sound waves**. Some knowledge of how this happens is necessary. |
| 5 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | The size of the **force on the conductor** depends on: the **magnetic flux density** , the **current** in the conductor and the **length** of conductor in the magnetic field. It can be calculated by **force (Newtons)= magnetic flux density (Tesla) x current (Amps) x length of wire (metres)** |
| 6 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | If an **electrical conductor** such as a metal wire **moves relative** to a **magnetic field** or if there is a change in the magnetic field around the conductor, a **potential difference** (voltage) 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** or **electromagnetic induction** and is how electricity is produced.  The size of the **induced potential difference** (voltage) can be **increased** by:  • increasing the **speed** of movement of the magnet  • increasing the **strength** of the **magnetic field**  • using **more turns** on the solenoid.  The direction of the current can be reversed by reversing the polarity of the magnetic or the direction of motion.  As with all currents, **an induced current creates a magnetic field around itself.** This magnetic field opposes the original change (**Lenz’s Law**). |
| 7 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | An **alternating current (ac) generator** is a device that produces a **potential difference**. It is a **coil of wire rotating** in magnetic field e.g. **Alternator** in cars, the current is constantly changing direction.  A **direct current (dc) generator** is another device that produces a potential difference. This current always flows in the **same direction** e.g. a **Dynamo**, the **magnet rotates** in a coil of wire.  The **microphone** is a device that converts sound waves into electrical signals. Microphones **use the generator effect** to induce a changing current from the pressure variations of sound waves. |
| 8 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | A **transformer** is a device that can **change the potential difference or voltage** of an alternating current – has to be a.c. so there can be a magnetic flux.  A basic transformer consists of a **primary coil** and a **secondary coil** wound on an iron core.  A **step-up transformer** **increases** the voltage and has more turns on the secondary. In the National Grid used to increase voltage, decrease current for more efficient transmission.  A **step-down transformer reduces** the voltage and has more turns on the primary. In the National Grid used before entering homes to decrease the voltage and increase the current making it safer. |
| 9 C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\542FDEB4.tmp | 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:  **=**  potential difference, *Vp* and *Vs* in volts, V  In a step-up transformer Vs Vp  In a step-down transformer Vs Vp  Also VsIs = VpIp as it is assumed that Transformers are 100% efficient. |