**Electricity Rules & Definitions**

Rules in italics are essential to know - there is a high likelihood of you needing these in the exam.

* Internal resistance is the resistance to the flow of electrons inside the battery or power source.
* Electromotive force is the maximum voltage supplied by the battery. This is the voltage across the terminals when the current is very small.
* Current is a measure of the number of charges flowing past a point per second.
* Voltage is a measure of the electric potential energy per unit of charge.
* *Kirchhoff’s current law: Current into a junction is equal to the current out of a junction.*
* *Kirchhoff’s voltage law: Around a loop the total voltage adds to zero.*
* Capacitors are parallel plates of conductors, separated by an insulator called a dielectric. They can store charge.
* The capacitance is a measure of how much charge a capacitor can hold.
* *The time constant of a capacitor is the time it takes to charge to 63% of maximum or the time it takes for the capacitor to discharge to 37% of the initial charge.*
* When two or more capacitors are addedin **parallel**, the area charge can be stored is increased, so more charge can be deposited on the capacitors.
* When two or more capacitors are added in **series**, the capacitance decreases. The charge on each capacitor is the same. The voltages add up to make the supply voltage.
* Faraday’s law: A voltage is induced when the magnetic flux inside a loop is changing.
* Lenz’s law: *The induced voltage always acts to oppose the change in magnetic flux.*
* Transformers are two coils of wire wound around an iron core. They are used to change the voltage of alternating current electricity.
* An alternating voltage across the primary coil causes an alternating current in the primary coil. This produces an alternating magnetic field in the core producing a flux change in the secondary coil resulting in an induced voltage across the secondary coil.
* Mutual inductance and is a measure of how well the **changing flux** in the first coil induces a **voltage** in the second coil.
* An inductor is a single coil of wire wrapped around an iron coil.
* *Inductors oppose the change in current.* (Lenz’s Law)They store energy in a magnetic field.
* The inductance is a measure of how much the inductor opposes the changing current.
* *The time constant of an inductor is the time it takes for the current to rise to 63% of maximum or the time it takes for the current to drop to 37% of the original current.*
* AC: *For resistors the voltage is high when the current is high.*
* AC: *In capacitors the voltage is high when the current is low.* This is because the voltage is high when the charge on the capacitor has built up to maximum. This occurs when the current has been moving in one direction for the longest possible time. *The voltage in a capacitor lags behind the current by 90 degrees*.
* AC: *In inductors the voltage is high when the current is low.* This is because the voltage is high when the current is changing the most rapidly. This occurs when the current is changing direction. *The voltage in an inductor leads the current by 90 degrees.*
* AC: *Reactance is a measure of how much a capacitor or inductor impedes the flow of electricity in the circuit.*
* AC: *Impedance is a measure of how much the whole circuit impedes the flow of electricity.*
* A large capacitance means the capacitor can store charge more easily, and the charge can flow on more easily, so a *larger capacitance results in a small reactance.*
* A high frequency means that the charge is taken on and off the capacitor quickly so less charge is built up on the capacitor. *So a large frequency results in a small capacitor reactance.*
* A large inductance means the inductor opposes the changing current strongly, so the reactance is large.
* *A high frequency means that the current is changing more rapidly and the inductor will create a larger opposing voltage, so the reactance is large.*
* *Resonance is when the current in a LCR circuit is at a maximum. This occurs when the impedance has the lowest possible value/ when the reactance of the capacitor cancels the reactance of the inductor/when the impedance equals the resistance of the resistor.*