Electro-Static Revision Notes

- Electric Current is a flow of electric charges, consisting of electrons. Two types of charges – positive and negative. No charge matter is neutral. Forces between charges are called electrostatic forces. – Like charges repel, unlike attract.

- Rule – charge must always be conserved, it cannot be created or destroyed.

- Current measured with an ammeter, voltage measured with a voltmeter.

- Current (I) = Charge (Q) / Time (t)

- Coulomb (C) is amount of charge passing a point when a current of an ampere flows for a second.

- Electricity is conducted only through material soluble in water when in water, aqueous solutions and in a molten state.

- Material allowing flow of charge is a conductor otherwise an insulator.

- Instrument used to show the existence of a charged object is called a gold leaf electroscope, which moves in a certain direction depending on the charge on the object once the leaf has been charged and another charged object is brought near it.

- Two main processes for an object to gain charge, other than friction – charging by contact and by induction (charge separation).

- Coulomb's Law – Force (F) = $(k.q_1.q_2) / r^2$

  Coulomb's constant is k, q is charge and r is distance – if more than two charges use vector addition – find the resultant.

- Electric field is produced by a charge or a combination of charges. Forces are felt depending directly on the test charge placed in the field.

- Electric Field, $E = F / q$

  $E = q / 4¶ \varepsilon_0 r^2$

- Comparison with gravity – Force felt by objects with charge – Force felt by objects with mass. Force proportional to size of charges – Force proportional to size of masses. Force inversely proportional to square of separation of charges - Force inversely proportional to square of separation of masses. Electric field round a charge - Gravitational field round a mass. Two type of charges (positive and negative) – one type of mass. Force attractive or repulsive – Force only attractive. Constant k and value depends on material – Constant G and fixed value. Electric force very strong but normally cancelled by charges - Gravitational force very weak unless a mass is large.

- Equipotential surfaces show how the electric potential varies around a charged object by identifying the areas where the potential is the same. Lines of equipotential are always at right angles to electric field lines and thus, are the only way to not do any work.

- At any point in a field, the direction of the field is shown by direction o f field lines closest to the point and the number of field lines that pass near the point show the magnitude of the field. Parallel field lines between two plates show a uniform electric field.
- Change in the electric potential energy = force * distance (Eq * d)

  Gain in kinetic energy = loss in potential energy (like in gravitational potential energy)
- Potential Difference (p.d.) = Energy difference / charge

  Work done between two points does not depend upon the path chosen by the test charge; the electric field is conservative.

- Electric Potential (V) = Work Done (W) / charge (q)

  For moving a test charge from an infinity point to a point in an electric field.

- $V = q / 4¶ \varepsilon_0 r$

  Single point charge only

- Energy = p.d. * charge

- Conventional current, opposite of current flows from positive to negative through convention electrons. The speed of theses electrons due to the current is called their drift velocity.

- Voltage (V) = Current (I) * Resistance (R)

- When current and potential difference are proportional, the device is called ohmic and vice versa for non-ohmic devices.

- Ohm's Law – Current flowing through a piece of metal is proportional to the potential difference across it providing the temperature remains constant. A device with constant resistance is called a resistor.

- Power (P) = I * V

- $P = I^2 * R$

- $P = V^2 / R$

- Two types of circuits – series and parallel.

- Series circuit – components connected in a chain, one by one. The current is the same everywhere while, the total p.d. is shared among the components.
- Resistance (Total) = R1 + R2 + R3…
- Parallel circuit – made of branches and thus, charge can go through more than one way. Same p.d. across each component but current is shared among the components.
- 1 / Resistance (Total) = (1 / R1) + (1 / R2) + (1 / R3)…
- Internal Resistance is the energy used up inside the component itself and is thus wasted and not all the available energy is being transferred from one terminal to another.
- Total energy difference per unit charge is the electromotive force.