13. Current of Electricity

Definitions

Electric Charge: When a constant current *I* flows through a cross section of a conductor for duration *t*, the amount of electric charge flowing through it is given by Q = It

Coulomb: One coulomb is defined as the amount of electric charge that passes through a point in a circuit in one second when there is a constant current of 1 ampere.

Potential Difference: The potential difference between two points in a circuit is defined as the amount of electrical energy per unit charge converted to other forms of energy when a charge passes from one point to the other. (V = W/Q)

Volt: One volt is defined as the potential difference between two points when one joule of electrical energy is converted to other forms of energy as one coulomb of charge passes from one point to another. $(1V = 1JC^{-1})$

Electromotive Force: The electromotive force of a source is defined as the amount of electrical energy per unit charge that is converted from other forms of energy to drive a positive unit charge around a complete circuit. (E = W/Q)

Resistance: The resistance of a conductor is defined as the ratio of the potential difference across it over the current flowing through it.

Ohm: The ohm is defined as the resistance of a conductor when a potential difference of one volt across it causes a current of one ampere to flow through it.

NOTE

- The 2 effects that affect the resistivities of the material when temperature increases are 1) Increase in no. of free electrons; more electrons able to break free from atoms as temperature rises, thus making the material a better electrical conductor and 2) lons vibrate faster and with greater amplitudes; making it even more difficult for electrons to pass through
- Resistance of metallic conductor increases as temperature increases (no effect 1, but has effect 2)
- Resistance of thermistor decreases as temperature increases (effect 1 greater than effect 2)
- Resistance is NOT given by the gradient of the graph of V against I because the gradient gives you CHANGE in V / CHANGE in I i.e. dV/dI, which is NOT what resistance is!
- MAX POWER THEOREM: A source of e.m.f delivers its maximum amount of power to a load when the resistance of the load is equal to the internal resistance of the source.
- **DURABILITY** \rightarrow decreases as power dissipated in heat increases
- **SHORT CIRCUIT** \rightarrow e.g. when dynode 3 and 5 are in short circuit, this means that there is ZERO resistance between them

Questions

- 1. (Questions on lamps not lighting up)
 - ➢ if p.d. across a lamp is zero = lamp is NOT broken
 - > if p.d. across a lamp is equal to voltage of supply = lamp is broken
 - > if p.d. across the first and last lamp is zero = wire is broken
 - if p.d across each lamp is zero but across the first and last lamp it's equal to the voltage of supply = wire is not connected properly to the first/last lamp