* Resistance and Resistivity *

Q-1) What is resistance?

> Resistance is the ratio of p.d accross a conductor to a current flowing through it.

rho = resistivity

$$R = \rho \times \frac{L}{A}$$

L - length

A - area of cross-section

Q-2) What is resistivity.

> Resistivity is the resistance of a conductor of unit length having a unit cross-sectional area.

$$\rho = \frac{R \times A}{L} \qquad \text{units} = \Omega m$$

Resistivity depends on:

- material
- temperature.

Conductors = temp ↑, resistance ↑

Semi-conductors = temp ↑, resistance ↓

alpha

$$\alpha = \frac{R_\theta - R_0}{R_0 \theta} \qquad \text{units} = {}^\circ C^{-1}$$

R_θ = R @ $\theta^\circ C$, R_0 = R @ $0^\circ C$

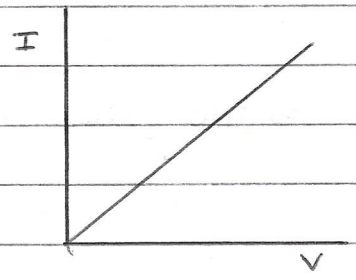
temperature coefficient of resistance.

$$R_\theta = R_0 (1 + \alpha\theta)$$

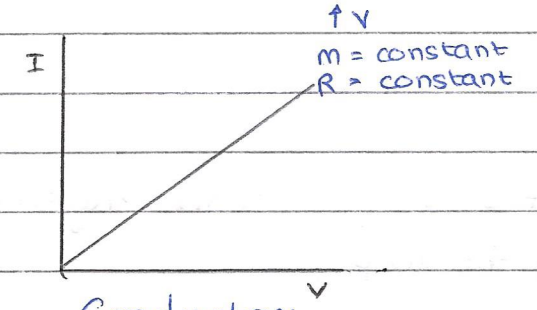
Factors affecting resistance

- length
- area of cross section (width)

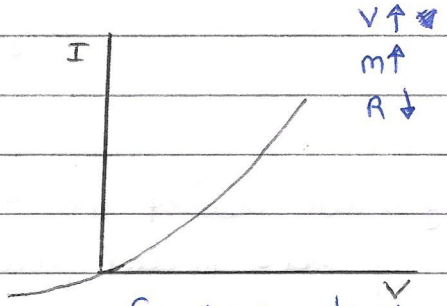
Q-3) Current and voltage graphs



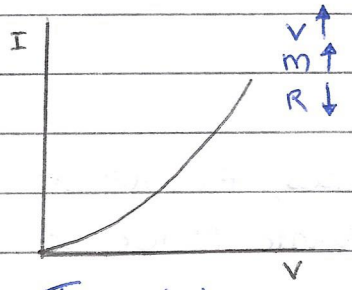
$R = \frac{1}{\text{gradient}}$.



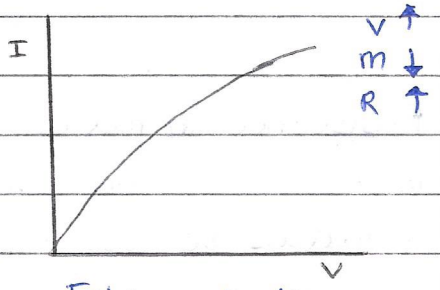
Conductor



Semi-conductor



Thermistor



Filament lamp.

Q-4) Resistors in series and parallel.

> Series ; $R = R_1 + R_2 + R_3 \ldots$ add all resistances.

Parallel ; $R = \frac{R_1 R_2}{R_1 + R_2}$ OR $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$

Q-5) Energy supplied and terminal p.d.

$E = IR + Ir$ (r → Resistance offered by materials inside the cell to oppose flow of current through it. internal resistance)

$= I(R + r)$.

Terminal p.d is the energy required to overcome the internal resistance (voltmeter reading)

When R is much greater than r, terminal p.d is very high; almost equal to e.m.f.

Q-6) What is Kirchoff's law?

① Current law.

Algebraic sum of current flowing into the junction is equal to the algebraic sum of current flowing out of the junction.

$$\Sigma I_{in} = \Sigma I_{out}$$

-> conservation of charge.

② Second law.

Algebraic sum of the e.m.f's is equal to the algebraic sum of p.d's in each part of the loop.

$$\Sigma E = \Sigma IR$$

-> conservation of energy.

Q-7) Resistance in metals.

> In metals, as the temperature increases, the resistance increases because the metal ions vibrate faster, so the obstruct the moving electron charges.

Impure metals have higher resistance than pure metals because the size of their atoms vary ∴ they obstruct the free flow of electrons.