

$\vec{j} = \frac{\Delta i}{\Delta s \cos\theta} = \sigma E$
 $\Delta s =$ area of cross-section
 $\theta =$ angle between Area vector & current flow
 $\sigma =$ conductivity

$emf = E = \frac{W}{q} = \frac{F_b}{d}$
 It is equal to the potential difference between the terminals when the terminals are not connected externally.

$$E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}, i = \frac{E_{eq}}{R + \frac{r_1 r_2}{r_1 + r_2}}$$

$$i = \frac{E_1 + E_2}{R + (r_1 + r_2)} = \frac{E_0}{R_1 + R_2}$$

$$E_0 = E_1 + E_2$$

Rate of flow of charge through an area.
 $i = \frac{Q}{t}$
 $i = \int \vec{j} \cdot d\vec{s}$

$V_A - V_B = E - ir$
 $r =$ internal resistance of the cell

Current density

$$V_d = \frac{i}{neA} = \frac{J}{ne}$$

Drift velocity

$$\mu = \frac{V_d}{E} = \frac{e\tau}{m}$$

$\tau =$ average collision time

Mobility

it is a device which maintains a potential difference between its two terminals

Current Electricity

$R = R_0 [1 + \alpha (T - T_0)]$
 $\rho = \int [1 + \alpha (T - T_0)]$
 $R =$ resistance at temperature T
 $R_0 =$ resistance at temperature T_0
 $\alpha =$ coefficient of resistivity

Temperature Dependence of Resistance

In 1827 Georg Simon Ohm gave his complete theory of electricity in his book "Die galvanische Kette, mathematisch bearbeitet"

Ohm's Law

$$J = \sigma E$$

or

$$V = IR$$

Resistance

$$R = \rho \frac{l}{A} \tau$$

Resistivity

$$\rho = \frac{1}{\sigma} \Omega m$$

Conductivity

$$\sigma = 1/E$$

Grouping of Resistance

Series grouping

$$R = R_1 + R_2 + R_3 + \dots + R_n$$

For two resistors
 $R = R_1 + R_2$

Parallel grouping

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$$


For two resistors
 $R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$

Kirchhoff's Law

Loop Law

The algebraic sum of all the potential difference along a closed loop is zero.

algebraic sum of all the currents directed towards a point (junction) is zero.
 $\sum I_p = 0$




Meter Bridge

Unknown resistance
 $S = \frac{R(100-l)}{l}$
 $l =$ balancing length
 $R =$ known resistance

Wheatstone Bridge

\cdot is balanced
 If $R_1 = R_3$
 $R_2 = R_4$
 No current through G



Potentiometer

$P = \frac{V_A - V_B}{l} = \frac{\text{potential difference}}{\text{length of wire}}$
 Comparison of emf, $\frac{E_1}{E_2} = \frac{l_1}{l_2}$
 Internal Resistance (r) = $R \left(\frac{l_1}{l_2} - 1 \right)$
 l_1, l_2 are lengths of null point