

Resistivity

$$R = \frac{\rho l}{A} \quad \rho = \frac{RA}{l} \quad \frac{\Omega m^2}{m} \quad \Omega m$$

Experiment to determine resistivity

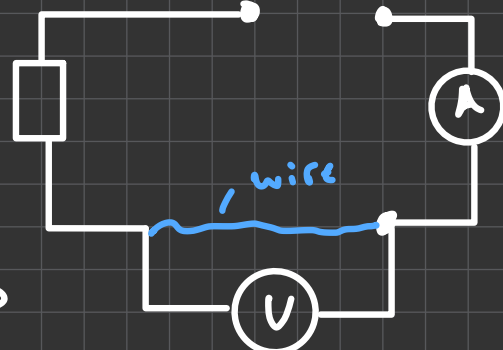
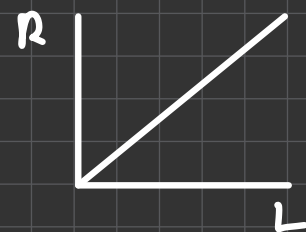
Measure the diameter of a wire with a micrometer, multiple readings along wire then average.

Calculate area using $A = \pi \left(\frac{d}{2}\right)^2 = \pi r^2$

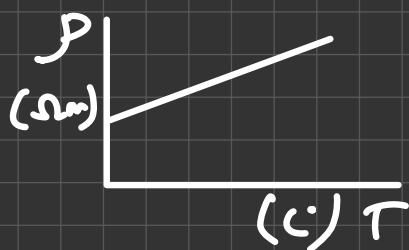
Vary the length, L Measure the p.d., V

Measure the current, I

Calculate resistance for each length by $R = V/I$
Plot a graph of R against L , graph should be straight line through origin.



Resistivity and temp



resistivity increases with temp due to more collisions

Internal resistance: lost volts per unit current

Terminal p.d. is the measured p.d. across the terminals of the cell and it is smaller than the EMF.

$$\mathcal{E} = \underset{\substack{| \\ \text{EMF}}}{V} + \underset{\substack{| \\ \text{terminal p.d.}}}{Ir} - \text{internal resistance}$$

$$\mathcal{E} = IR + Ir$$

$$\mathcal{E} = I(R+r)$$

Vary the resistance of the variable resistor, to change the resistance in the circuit

Measure the current in the circuit
Measure the terminal p.d.

Take multiple readings and average to improve accuracy of experiment.

Plot a graph of V against I

$$\mathcal{E} = V + Ir$$

$$V = \mathcal{E} - Ir$$

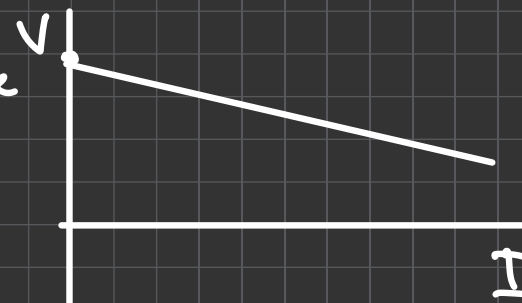
$$V = -Ir + \mathcal{E}$$

$$V = -r \times I + \mathcal{E}$$

$$y = mx + c$$

y intercept = EMF

gradient = $-r$



$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

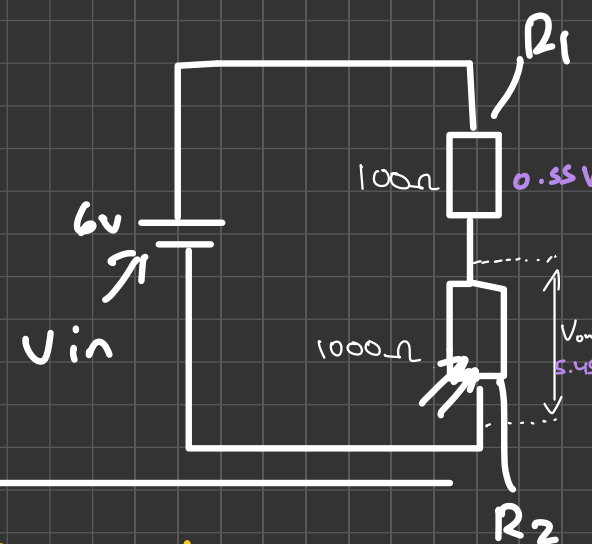
Chapter 10 Resistance and Resistivity

Potential divider circuits

$$V_{out} = \frac{R_2}{R_1 + R_2} \times V_{in}$$

$$V_{out} = \frac{1000}{1100} \times 6 = 5.45V$$

V_{out} is across R_2



Combining resistors

Series:



$$R_T = R_1 + R_2$$

$$R_T = 300\Omega$$

Parallel:



$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_T = \left(\frac{1}{100} + \frac{1}{200}\right)^{-1} = 67\Omega$$

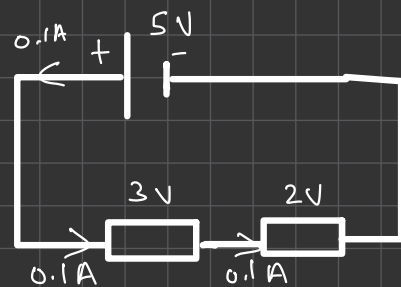
Kirchoffs 1st Law: sum of current entering a junction = sum of current exiting a junction

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Statement of conservation of charge

Kirchoffs 2nd Law: Sum of EMFs in a closed loop = sum of p.d.s

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Statement of conservation of energy

Series circuit

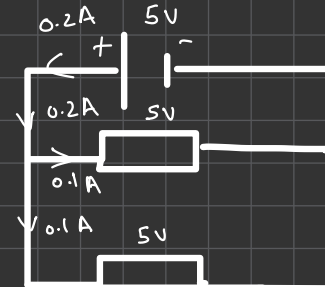


One path for current to flow

Current the same across components

voltage is shared

Parallel circuits



Current splits at a junction

p.d. is the same across the ends of each individual loop.