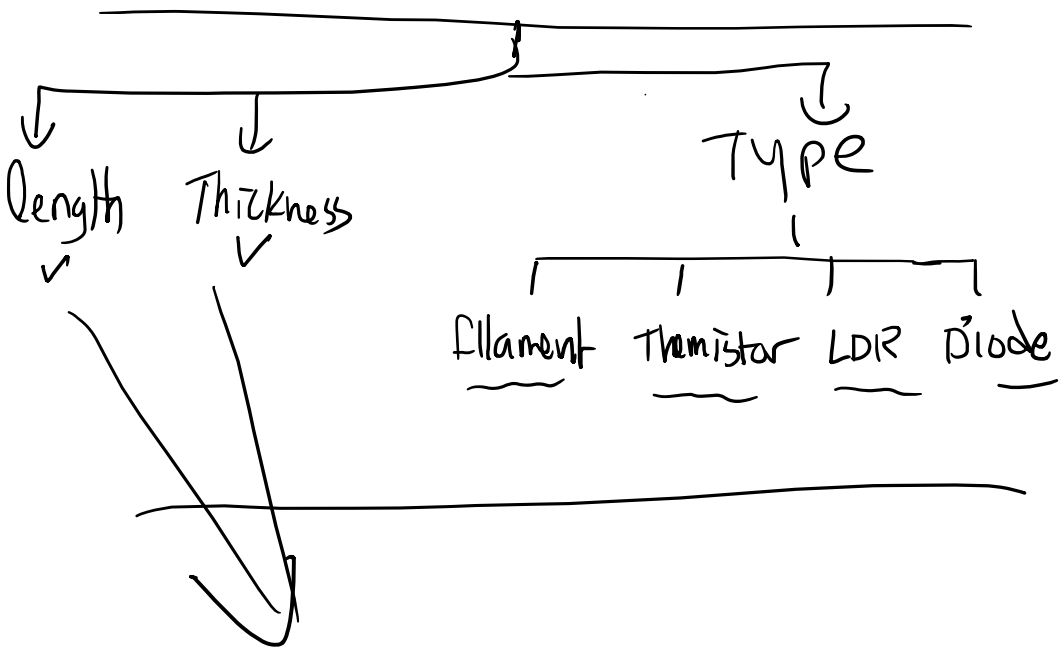
Some Resistors are NOT constant.




$R \propto l$

A resistor has 100Ω of resistance. Its length is 20cm. Calculate its resistance at a length of 60cm.

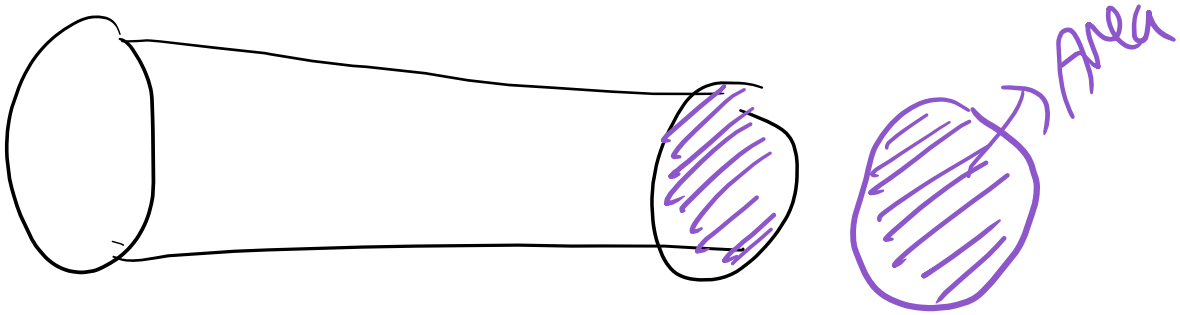
$$R \propto l \Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2}$$

$$= \frac{100}{R_2} = \frac{20}{60}$$

$$R_2 = \frac{100 \times 60}{20} = 300\Omega$$

$$R \propto \frac{1}{CSA}$$

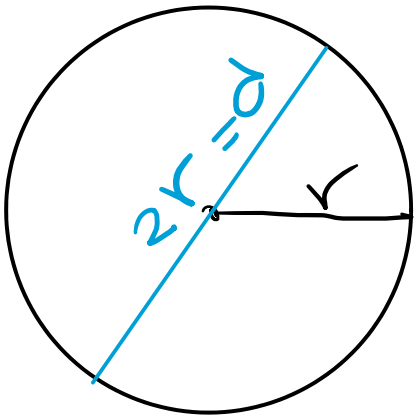
cross-section Area



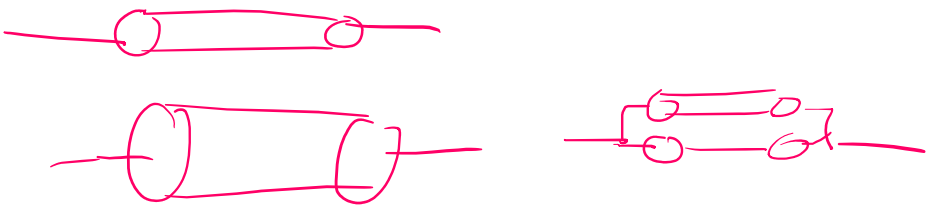

$$A = \pi r^2$$

$$r = \frac{\text{diameter}}{2}$$

$$A = \pi \frac{d^2}{4}$$




$$\left(\frac{d}{2}\right)^2 = \frac{d^2}{4}$$



A resistor of 100 Ω & CSA $2\ cm^2$ calculate its resistance if its thickness becomes $0.5\ cm^2$

$$R_1 \propto \frac{1}{A_1}$$

$$\frac{R_1}{R_2} = \frac{A_2}{A_1}$$

$$\frac{100}{R_2} = \frac{0.5}{2}$$

$$R_2 = \frac{100 \times 2}{0.5} = 400\ \Omega$$

A wire of length 3cm & CSA of 4 $cm^2$ has a resistance of 100Ω., another wire of the same material. has a length of 5cm & CSA of 6 $cm^2$.

calculate its Resistance.

$R \propto l$ $R \propto \frac{1}{A}$

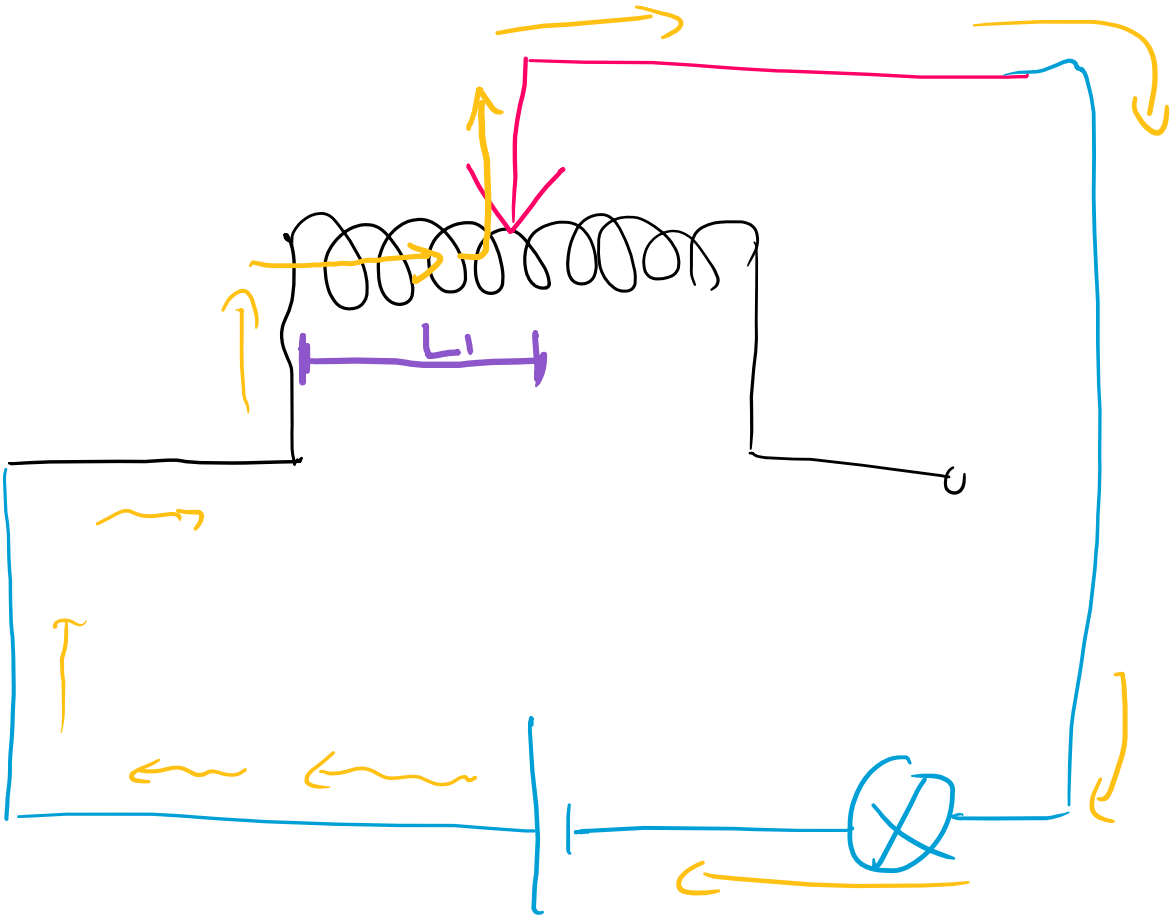
$R \propto \frac{l}{A}$

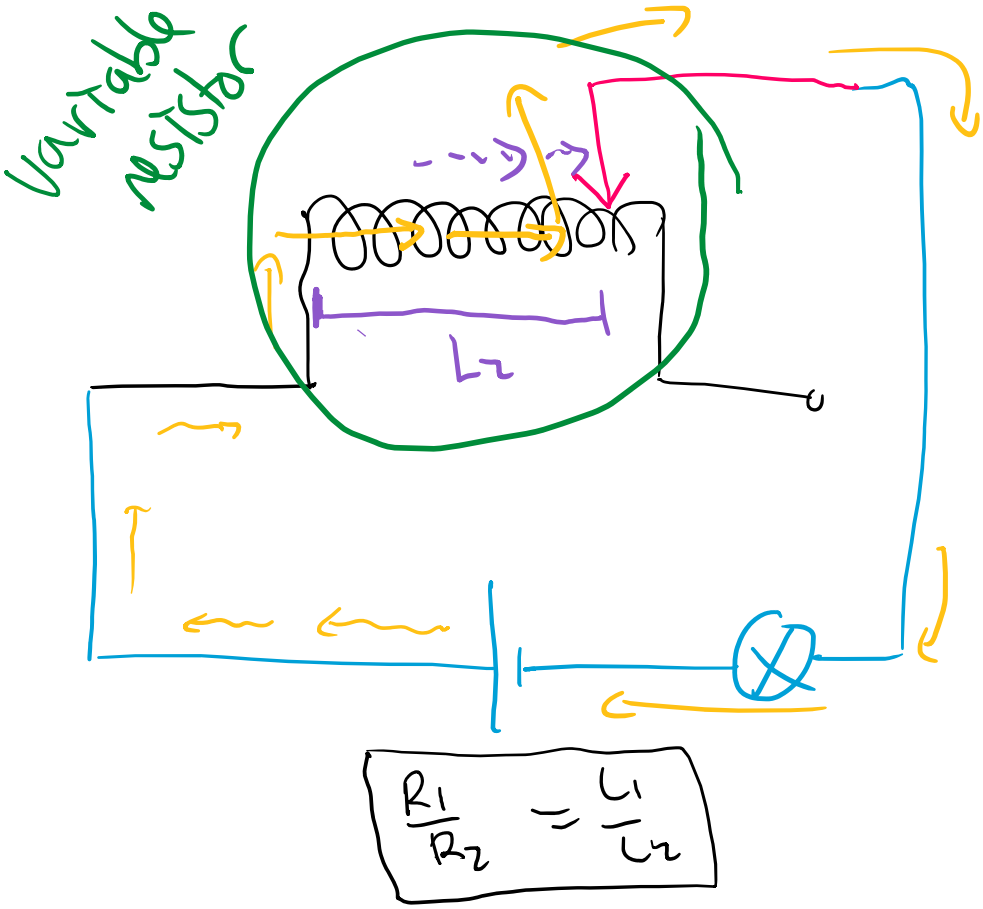
if I compare.

$$\frac{R_1}{R_2} = \frac{l_1 A_2}{l_2 A_1}$$

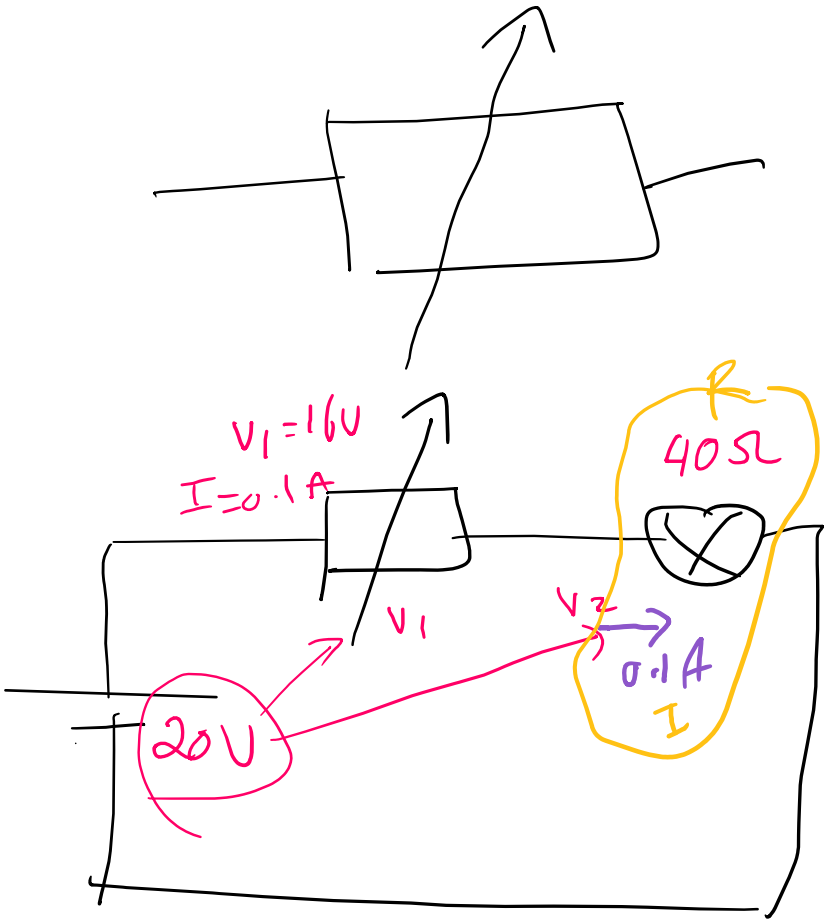
$$\frac{100}{R_2} = \frac{4 \times 6}{5 \times 4}$$

$$R_2 = \frac{100 \times 5 \times 4}{4 \times 6} = 83.3\ \Omega$$




$$\frac{R_1}{R_2} = \frac{L_1}{L_2}$$




$$\frac{V = IR}{\frac{R_1}{R_2} = \frac{L_1 A_2}{L_2 A_1}}$$

the lamp needs 0.1 Ampere to work properly. calculate the Resistance of the variable resistor

$Emf = V_1 + V_2$

$20V = 16 + 4$

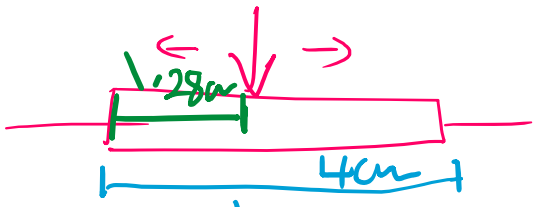
$V_2 = I_2 R_2$

$V_2 = 0.1 \times 40$

$= 4V$

$V_1 = I_1 R_1$ $\quad R_1 = \frac{V_1}{I_1} = \frac{16}{0.1} =$ 160Ω

If the total length of the variable resistor is 4cm, and its maximum resistance is 500Ω, calculate the length to adjust its resistance to 160Ω.




$L_1 = 4\text{cm}$

$R_1 = 500\Omega$

$R_2 = 160\Omega$

$L_2 = ?$

$$\frac{R_1}{R_2} = \frac{L_1}{L_2}$$

$$R_1 L_2 = R_2 L_1$$

$$L_2 = \frac{R_2 L_1}{R_1} = \frac{160 \times 4}{500} = 1.28\text{cm}$$

# 5 types of Resistors

| 1- Regular | 2- filament | 3- Thermistor | 4- LDR (light dependent) | 5- Diode (direction) |
|---|---|---|---|---|
| Heat ↑ | Heat ↑ | Heat ↑ | Light ↑ | direction |
| R → const | R ↑ | R ↓ | R → const | R → const |
| V → const | V ↑ | V ↓ | V → const | V → const |
| I → const | I ↓ | I ↑ | I → const | I → const |
| Light ↑ | Light ↑ | Light ↑ | Light ↑ | direction |
| R → const | R → const | R → const | R ↓ | R → const |
| V → const | V → const | V → const | V ↓ | V → const |
| I → const | I → const | I → const | I ↑ | I → const |
| direction → ← | | | | direction 1 |
| R const | R const | R const | R const | R ↓↓↓ |
| V const | V const | V const | V const | almost zero |
| I cons | I const | I const | I const | V ↓↓↓ |
| | | | | I ↑↑↑ |
| | | | | direction 2 |
| | | | | R ↑↑↑↑ |
| | | | | V ↑↑↑ |
| | | | | I almost 0 |