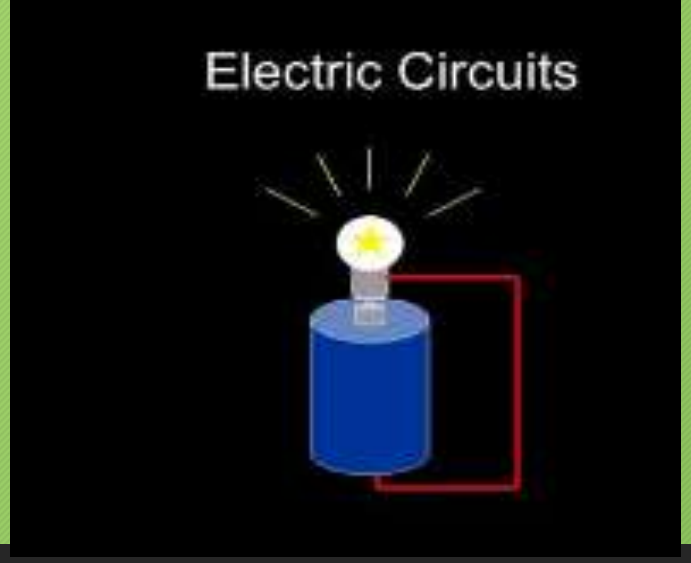


ELECTRICITY

19TH-25TH APRIL

Prepared by
Teacher mayanja joseph
Light academy secondary school

Factors that affect resistance

Temperature,

Conduction in metals is by free electrons. The drift electrons however are abstracted by atoms in their lattice positions.

When temperature of the metal increases, the atoms vibrate with a larger amplitude thus reducing the means free path of the free electrons reducing the drift velocity of free electrons hence increase in resistance

Length,

- ✓ the longer the conductor, the higher the resistance and the shorter the conductor the lower résistance.
- ✓ Free electrons collide more frequently with atoms, at each collision they lose some kinetic energy to atoms vibrating at fixed mean positions.
- ✓ This leads to a decrease in the drift velocity of the electrons and hence an increase in resistance.

Cross sectional area

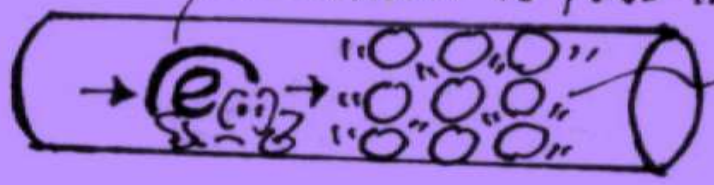
The thinner the conductor, the higher the resistance and the thicker the conductor, the lower the resistance.

When there is an increase in the cross sectional area the number of free electrons that drift along the conductor also increases.

This leads to an increase in current hence a decrease in resistance.

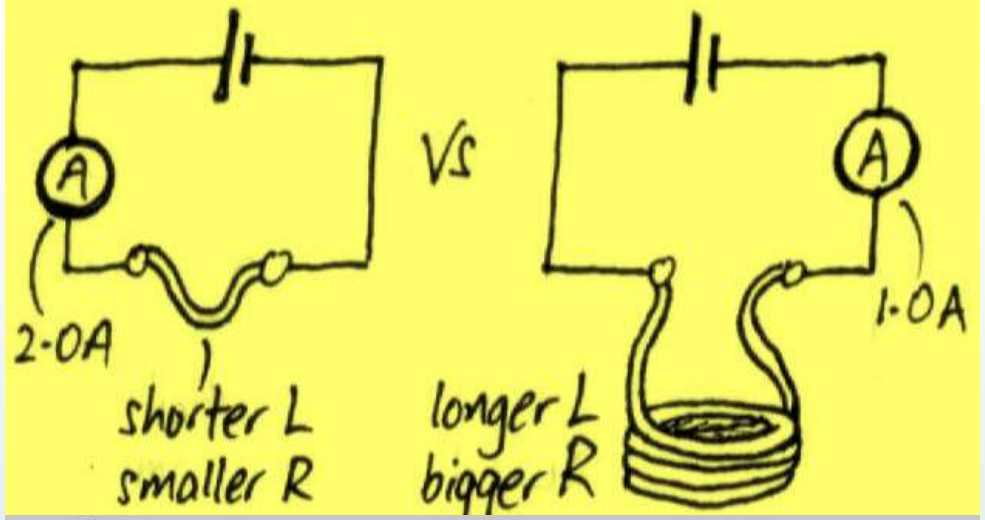
https://youtu.be/w4xT6jMoubQ

① Temperature, T T↑ R↑



As temperature increases, the particles of the conductor vibrate more vigorously about their fixed positions. It is harder for the electrons to flow through. ∴ R ↑

② Length, L L↑ R↑



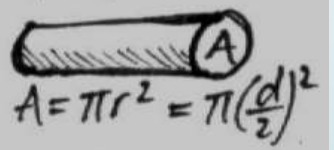
③ Resistivity, ρ ρ↑ R↑

- Resistivity, ρ (Ωm) ≠ Resistance, R (Ω)
- ρ is unique to the material.
- copper $\rho = 1.68 \times 10^{-8}$ Ωm
- nichrome $\rho = 1.1 \times 10^{-6}$ Ωm

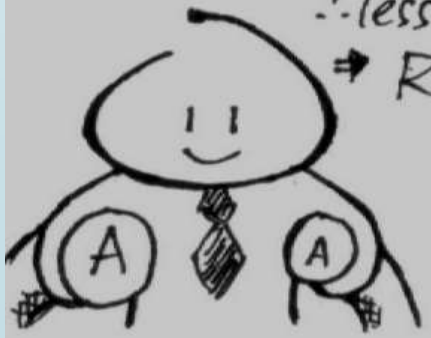
∴ copper with higher ρ, will give higher R.

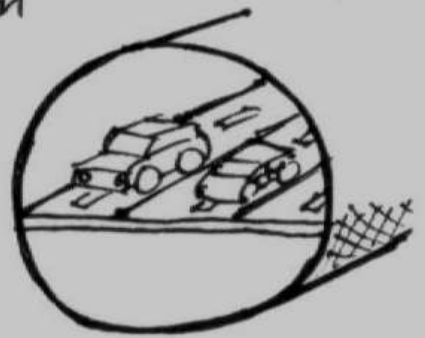
④ Cross-Sectional Area, A

A↑ R↓



You can imagine with bigger A, the more lanes there are on the road.
∴ less jam
⇒ R↓

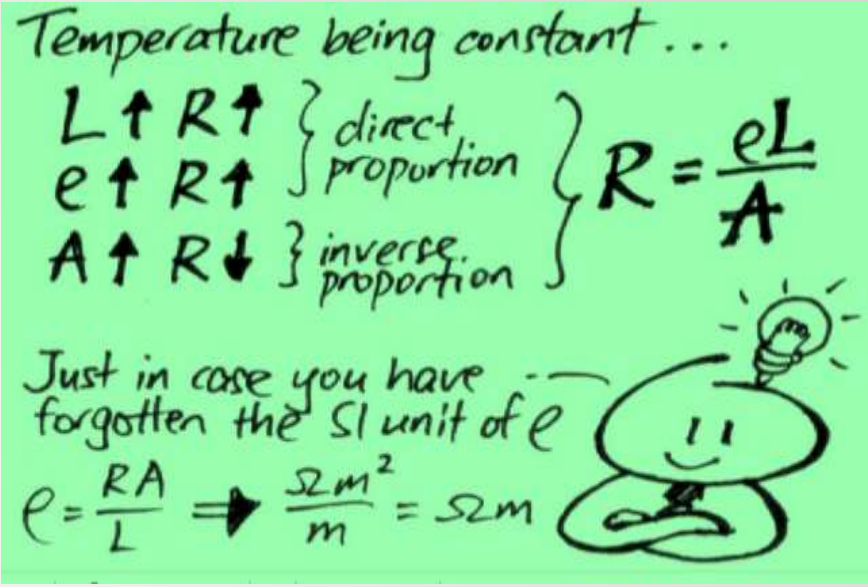




The above factors can be combined as

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

$$R = \frac{\rho L}{A}$$ Where ρ is resistivity



Definition

Electrical Resistivity is the resistance across opposite faces of a 1m-cube of a material.

Resistivity is the electrical resistance across opposite faces of a 1m-cube of a material.

Conductivity, σ

The conductivity of a material is the reciprocal of its resistivity. It is denoted by σ. $\sigma = \frac{1}{\rho}$

The S.I unit of conductivity is $\Omega^{-1}m^{-1}$

https://youtu.be/sPFII3ozSHI

EXAMPLES

1. A conductor of length $20cm$ has a cross sectional area of $2x10^{-4}\ m^2$. Its resistance at $20℃$ is 0.6Ω. find the resistivity of the conductor at $20℃$.

2. A wire of diameter 14mm and length 50cm has its resistivity as $1.0\ x10^{-7}\ \Omega\ m$. What is the resistance of the wire at room temperature?

Prepared by
Teacher Mayanja joseph
Light academy secondary school

e-light platform