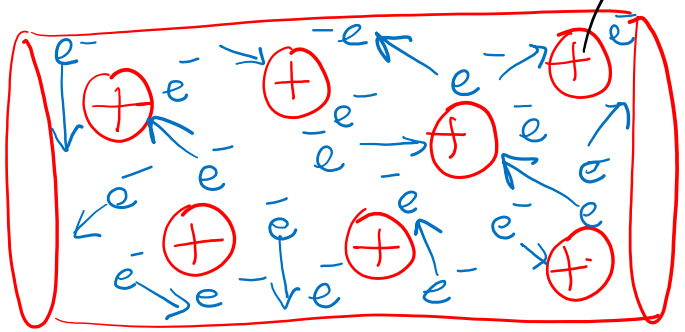
Electric current

(Current $-I\rightarrow$ flow of Positive charge)

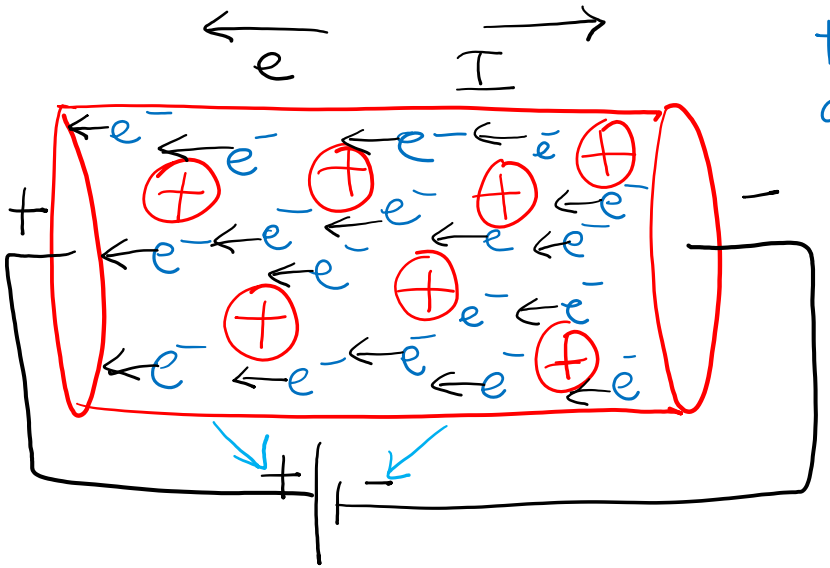


motion of electrons $e^- \rightarrow$

$\leftarrow \oplus$

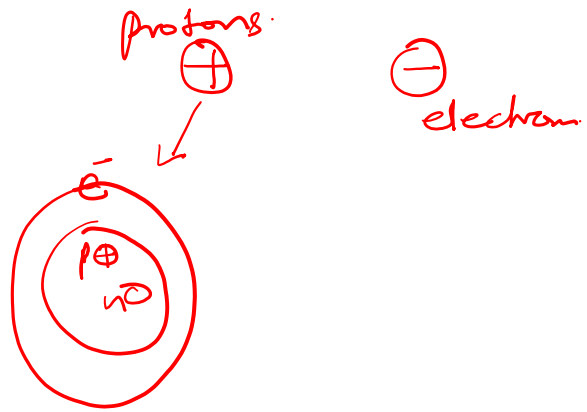
I

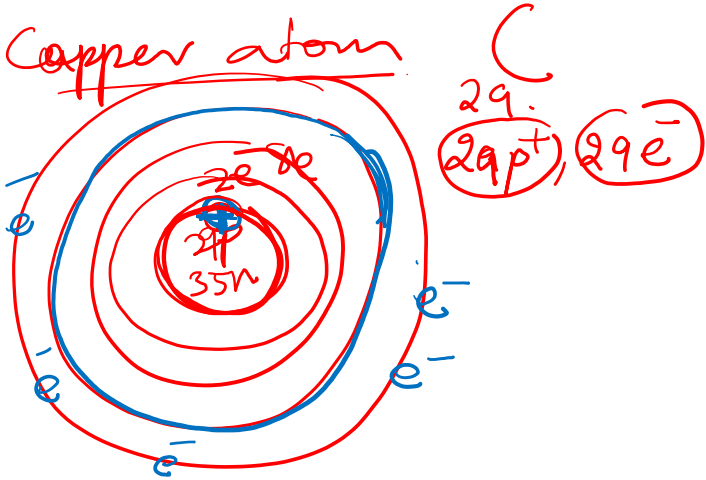
current I is opposite to the direction of motion of electrons.



V (drift velocity)

electrons drift because applied voltage as it collides repeatedly with heavy + atoms.





good conductors → lot of free electrons.

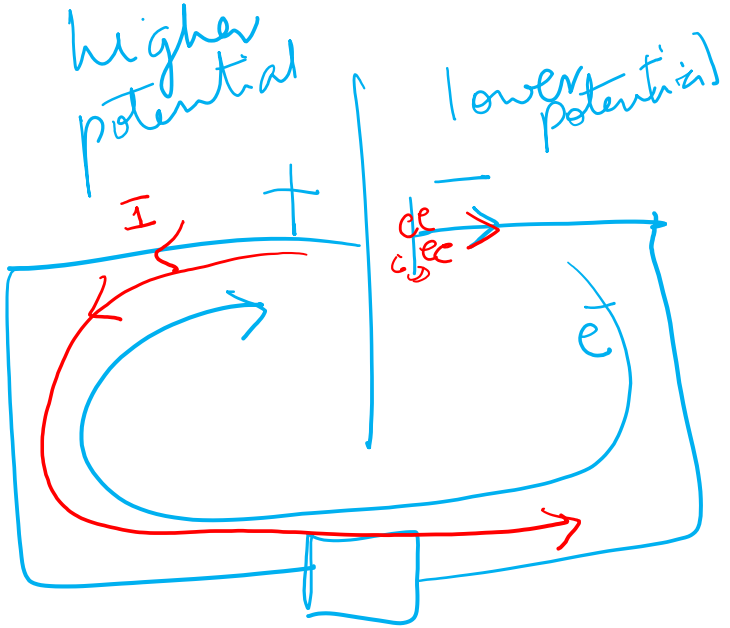
I Need A Van Everytime

$I = n A V_d e$

$I = nAV_d$

$$I = n A V_d e$$

$$\boxed{I = n A V q.}$$



[$e \rightarrow q.$
electron charge

$V \rightarrow$ drift velocity of electrons
(V_d)

$A \rightarrow$ Area of cross section

(number density of free electrons) $\leftarrow n \rightarrow$ no. density of free electron

$$\left[n = \frac{\text{no. of electrons}}{\text{Volume}} \right]$$

$e \rightarrow$ electron charge.

Charge →

3C.

P

+e

e

−e

fundamental charge.

(Smallest charge).

$e = 1.6 \times 10^{-19}$ C

(Coulomb)

SI of charge

~~0.5e~~ ~~1.35e~~

1e, 2e, 3e ..... ne.

Charge is quantised → packets

$Q = ne$

$n = 1, 2, 3 \ldots$

1e

2e

3e

ne

Total charge ← $Q = ne$ → charge of each electron

no. of electrons

~~0.5e~~

~~0.75e~~

Current:-

I → rate of flow of charges.

$$I = \frac{\Delta Q}{\Delta t} = \frac{ne}{t}$$

$$I = \frac{q}{t} \rightarrow q = It$$

$$\Delta Q = I \Delta t$$

amperes.

$$1A = \frac{1C}{s}$$

Δt – 1s

ΔQ = 3c.

$$I = \frac{\Delta Q}{\Delta t} = \frac{3C}{1s}$$

$$3A = 3\ C/s$$

$$10 = 10\ C/s.$$

(t) (Q)

(Q.) in 5 s, 250 m C

$$I = \frac{\Delta Q}{\Delta t} = \frac{Q}{t} = \frac{250\ mC}{5\ s} = 50\ mA$$

$$1mC = \frac{1}{1000}C$$

$$1mC = 10^{-3}C$$

One Ampere current

[when 1C flows in 1s.]

1 Coulomb

(one electron) $1e \longrightarrow -1.6 \times 10^{-19}$ C

? ——— 1 C

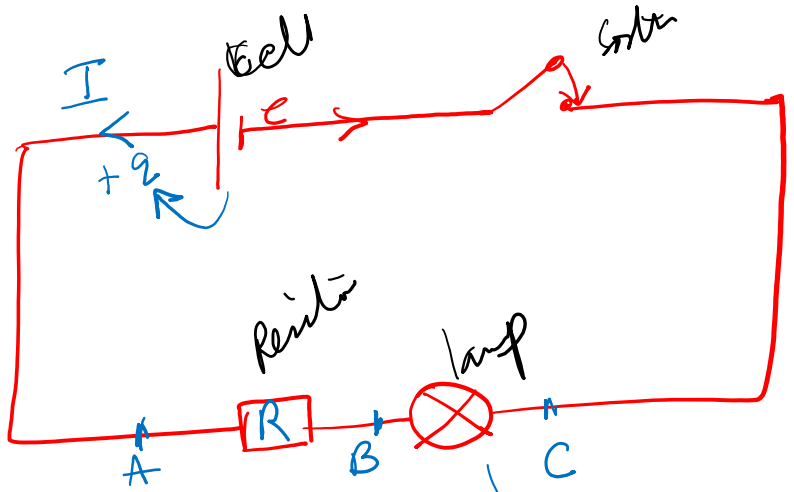
$$n = \frac{1}{1.6 \times 10^{-19}} \text{ electron in } 1C$$

$$= 6.02 \times 10^{+18} \text{ electron}$$

6000000000000000000 electrons in 1 coulomb.

Electric Circuit

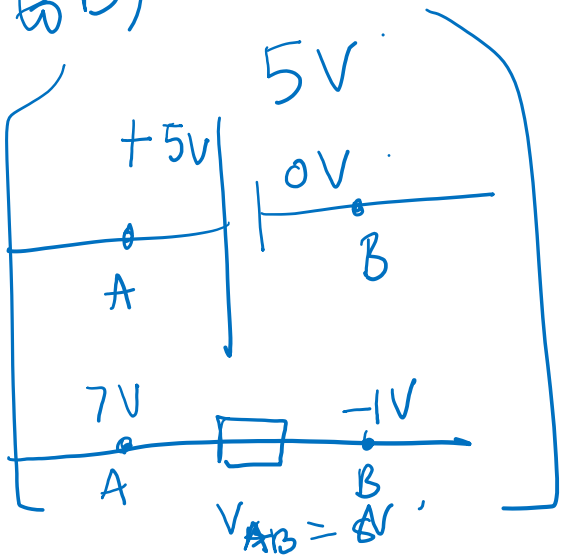
closed circuit → electric current flows through a complete path.



$V_{AB} (= V_A - V_B)$

$V_{BC} = \frac{W}{q}$

$V_{AB} = \frac{W}{q}$ (A to B)



$V_{AB} = 5V$

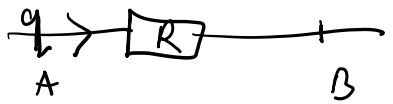
between any two points

potential difference → cell

Voltage / emf

$$V = \frac{\text{energy}}{\text{charge}} = \frac{\text{work}}{q} = \frac{W}{q}$$

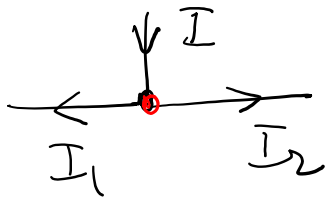
$$\text{emf} = \mathcal{E} = \frac{W}{q}$$ (to make the charge move through entire circuit)



10 J
2 C

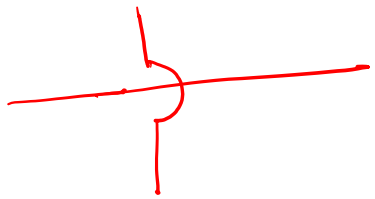
$V = \frac{E}{C} = \frac{10\text{ J}}{2\text{ C}} = 5\text{ V}$

KCL



connected wires

disjoint wires

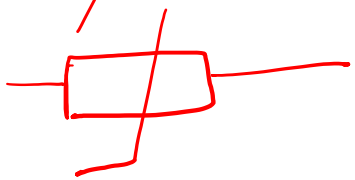


I

fuse

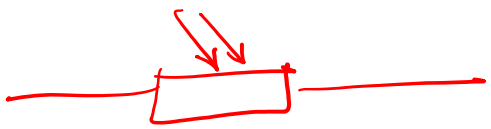
Resistor — T↑ R↑

variable resistor



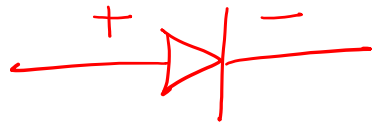
Thermistor

T↑ R↓



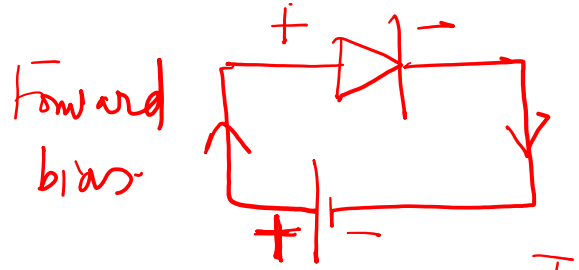
LDR Intensity↑ R↓

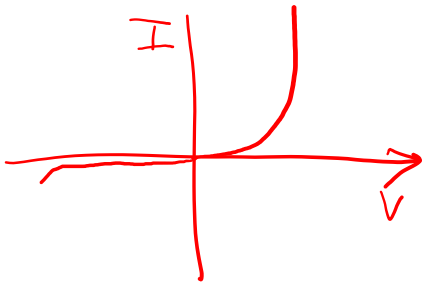
Heating element

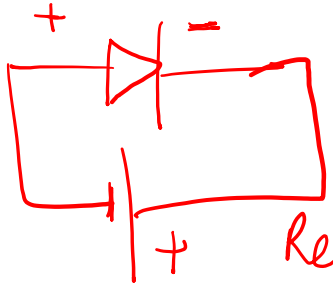


Diode

Valve — allows current in only one direction

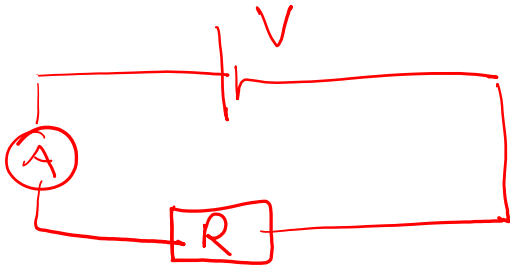


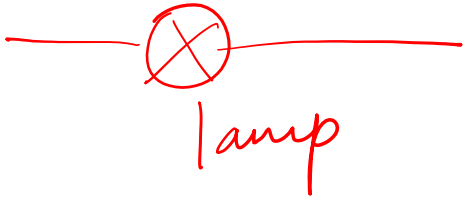


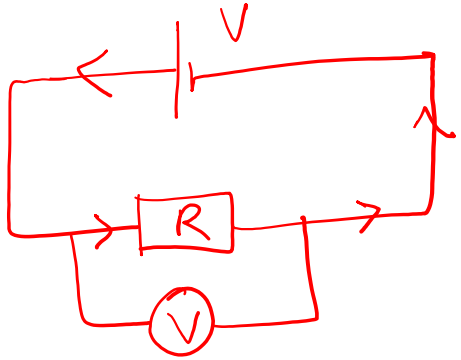


Reverse bias

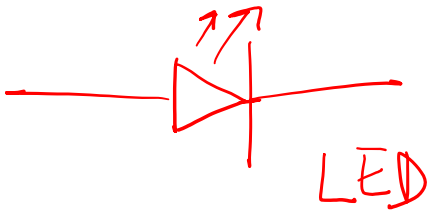
Resistance of Ammeter = 0 (very low)

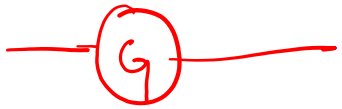






↳ Resistance ∞ (ideally)
very high (practically)





↳ Galvanometer — detect minute currents.

$\Delta Q = N e$.

$n = \frac{\text{Total electrons}}{\text{Volume}} = \frac{N}{V}$.

$N = n \times \text{Volume}$

capacitor (store charges)