Electronic engineer

Oswaldo Andrés Ordóñez Bolaños

“Engineering is the art of directing the great sources of power in nature for the use and convenience of man.”

- Thomas Tredgold

Objetives

- [ ] Deep understanding Big four

Big Four

Voltage – Current – Resistance - Power

Behavior of the electrons

Matter:

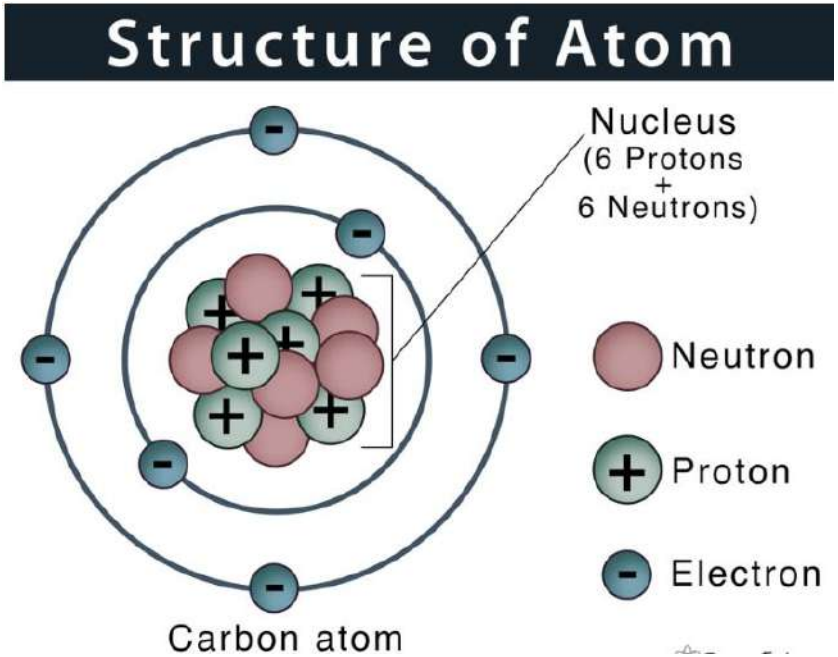
- Occupies space
- Has Weight (mass)

Elements:

- Basic building block of nature

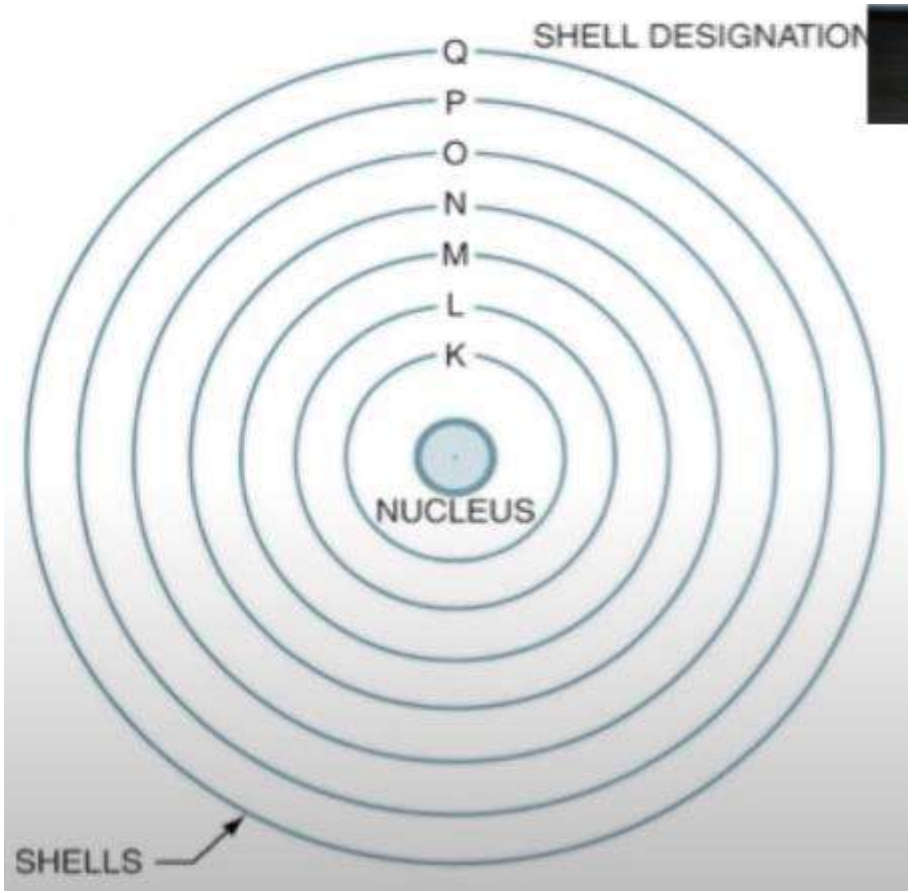
Parts of an atom:

- Nucleus – Located at center of atom
- Protons : Positively charged particles inside nucleus
- Neutrons: Uncharged particles inside nucleus
- Electrons: Negatively charged particles that orbit the nucleus
- Shells: orbit that electrons follow.
- Valence Shell: the outermost Shell.



Atomic number:
The number of protons in the nucleus of the atom.

Atomic weight:
The mass of an atom. Total number of protons and neutrons in the nucleus


SHELL DESIGNATION
Q
P
O
N
M
L
K
NUCLEUS
SHELLS

Why?

“

- *Identify the **properties of materials** that we used in electronics.*
- *Where voltage comes from.*

Electric ***Conductors***

Materials that readily **accept** the Flow of electrons or electricity.

3 valence shell.

Insulators

Prevent the Flow of electricity.

5 valence shell.

Each material has a property


1KILO
Fine Silver
999.0

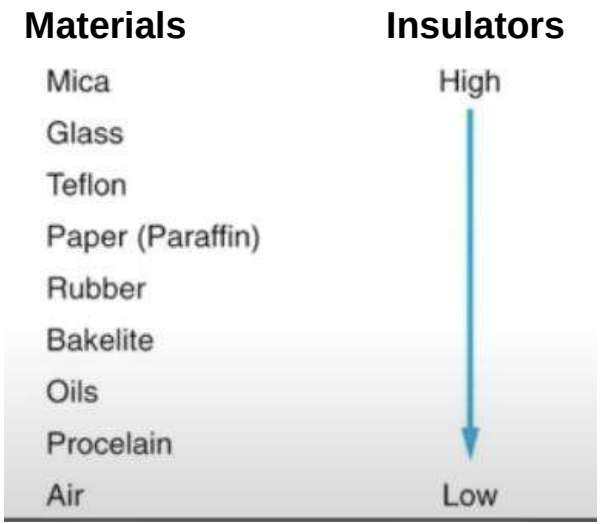

Ti
22
Titanium

Electric Conductors

Insulators

Resistivity and Temperature Coefficient at 20 C

Material	Resistivity ρ (ohm m)		Temperature coefficient α per degree C	Conductivity σ x 10^7 /Ωm
Silver	1.59	x10^{-8}	.0038	6.29
Copper	1.68	x10^{-8}	.00386	5.95
Copper, annealed	1.72	x10^{-8}	.00393	5.81
Aluminum	2.65	x10^{-8}	.00429	3.77
Tungsten	5.6	x10^{-8}	.0045	1.79
Iron	9.71	x10^{-8}	.00651	1.03
Platinum	10.6	x10^{-8}	.003927	0.943



Semi conductors

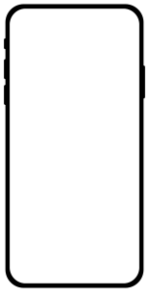
4 valence Shell
*Material whose conductivity **lie between***
the conductor and insulator


Kiwi Landing Pad
San Francisco
Alameda
San Leandro
Daly City
San Francisco Bay
South San
Hayward
Pleasanton
YouTube
Pacifica
Burlingame
ORACLE
Union City
San Francisco State Fish and Game Refuge
Highlands-Baywood Park
Fremont
Sunol Regional Wilderness
facebook
Genentech
STANFORD UNIVERSITY
Half Moon Bay
Palo Alto
Ed Levin County Park
HP's founding garage
YAHOO!
165 University Avenue
Google
El Corte de Madera Creek Trail
Steve Jobs' Family Home
intel
CISCO
ebay
Cupertino
La Honda

Where Voltage comes from

Negative ION

A negatively charged atom



Neutral natural state

Friction

Or another stimuli

Positive IOT

A positively charged atom

Generate electricity

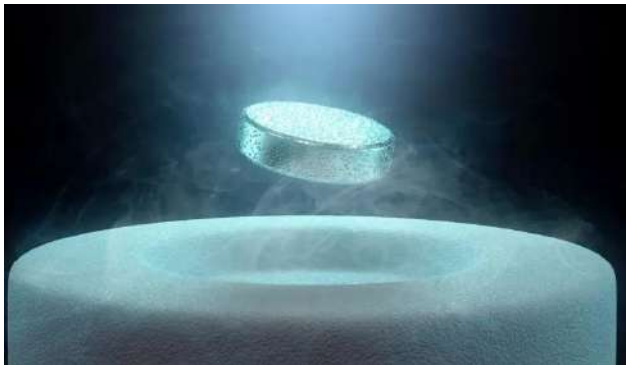
Apply energy to matter.

Ionization

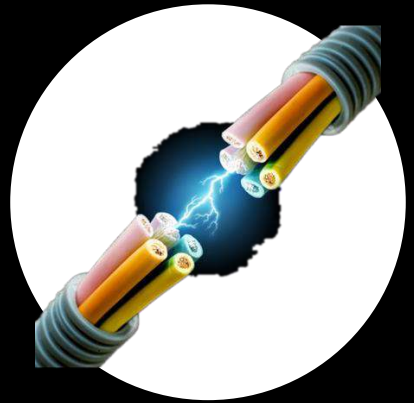
Process of gaining or losing electrons

Super conductor

Low temperature



Meissner effect



Current (I)

Movement of electrons from negatively charged atoms to positively charged atoms (disordered movement).

Coulomb

- $C = 6.24x10^{18}$

Ampere

One coulomb moving past a single point in one second.

Represent by A.

Voltage (V–E) *volt*

Force that moves the electrons in the circuit.

the pressure or pum that moves electrons

Potential

- *The ability of the source to perform electrical work*

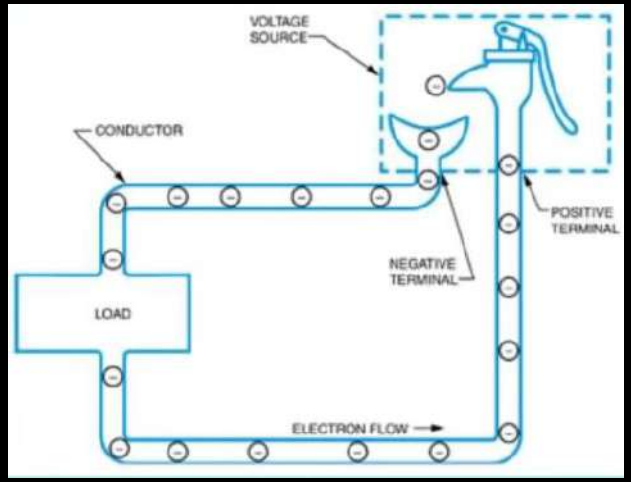
Difference of potential

Causes electrons to move or Flow in a circuit.
Referred to as electromotive force (emf) or voltage.

Resistance (R) *Ω ohm*

Opposition to the flow of electrons.

Mesure in Ohms – George Simon Ohm


VOLTAGE SOURCE
CONDUCTOR
POSITIVE TERMINAL
NEGATIVE TERMINAL
LOAD
ELECTRON FLOW

Analogies

In Summary

Conductors

- **Low resistance to current Flow**
- **Many free electrons.**

Insulators

- **High resistance to current Flow**
- **Few free electrons.**

Matter

Elements

Atoms

- **Nucleus (place)**
- **Protons**
- **Neutrons**
- **Electrons**

Atomic number (+)

Atomic weight (+,n)

Shell

- **Valence shell**

In Summary

Ionization (take out)

Current

Coulomb

Ampere

Electric current

Potential or electromotive force

Matter

Elements

Atoms

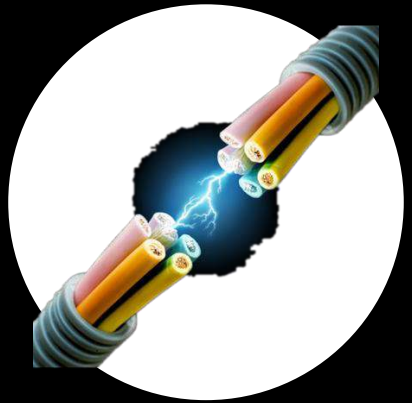
- **Nucleus (place)**
- **Protons**
- **Neutrons**
- **Electrons**

Atomic number (+)

Atomic weight (+,n)

Shell

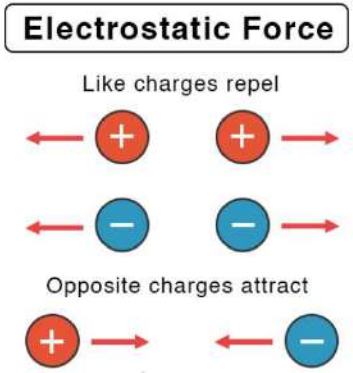
- **Valence shell**



Current (I)

Movement of electrons from negatively charged atoms to positively charged atoms (disordered movement).

Law of electrostatic charges



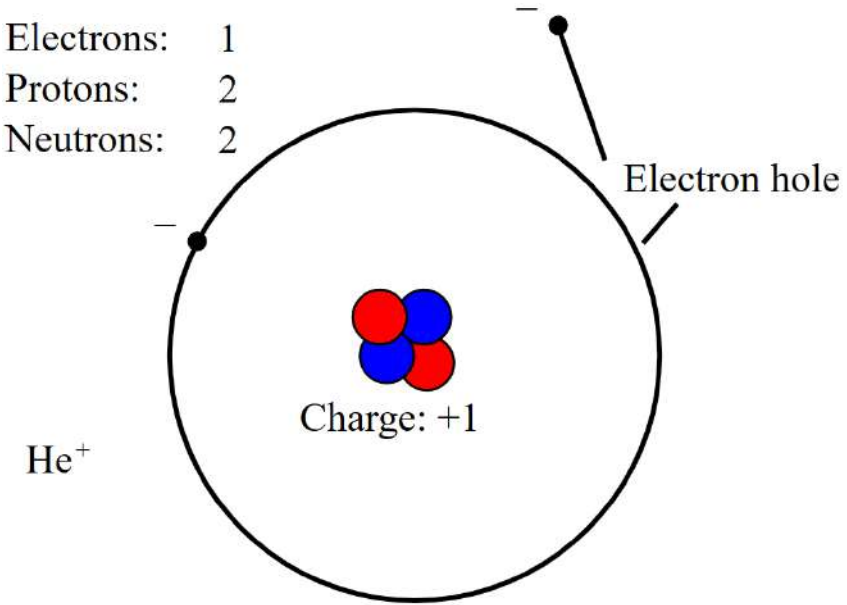
Current equation

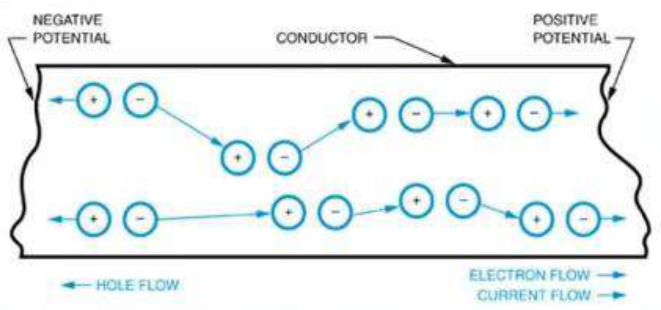
The relationship between amperes and coulombs per second can be expressed as:

$$I = \frac{Q}{t} = \frac{dQ}{dt}$$

- I = current measured in amperes
- Q = quantity of electrical charge in coulombs
- t = time in seconds.

Hole


Electrons: 1
Protons: 2
Neutrons: 2
Electron hole
Charge: +1
He^+


NEGATIVE POTENTIAL
CONDUCTOR
POSITIVE POTENTIAL
HOLE FLOW
ELECTRON FLOW
CURRENT FLOW

Voltage (V–E) *volt*

Force that moves the electrons in the circuit.

the pressure or pum that moves electrons

Voltage source

- Supplies electrons from one end of the conductor.
- Removes electrons from the other end of the conductor.

Friction
- Van de Graff generator - Torments

Magnetism *(Faray law)*
- Powered by steam from nuclear power or coal, water, wind, or gasoline or diesel.
- Produced using generator.

Chemicals
- Cell
- Copper / Zinc
- Many cells can be connected to form a battery

Light: Photovoltaic cell

Heat : Termocuple

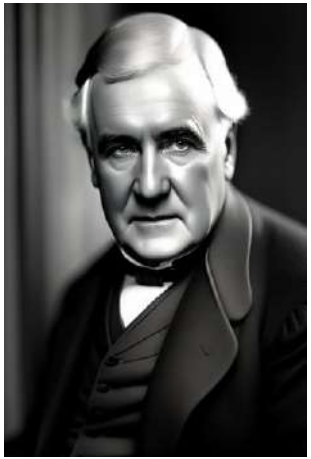
Pressure: Piezoelectric effect.

Direct current
Alternating current

Voltage Source

Direct current

Electrons Flow in only one direction.

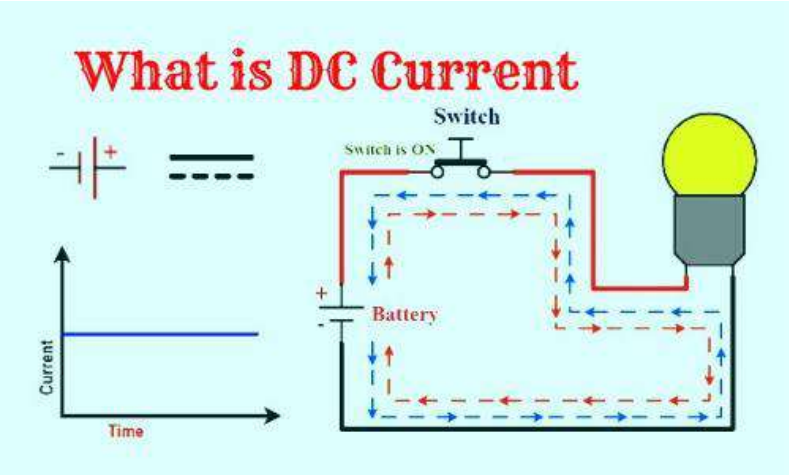


Alternating current

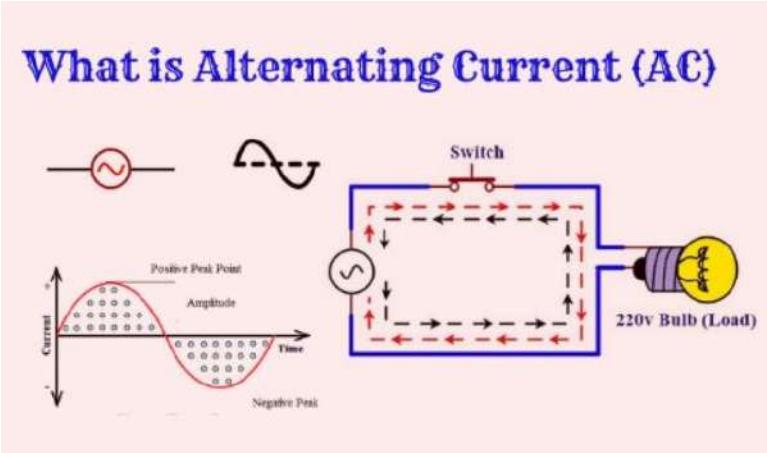
Electrons Flow in one direction, then in the opposite direction.

Voltage Source

DC



AC



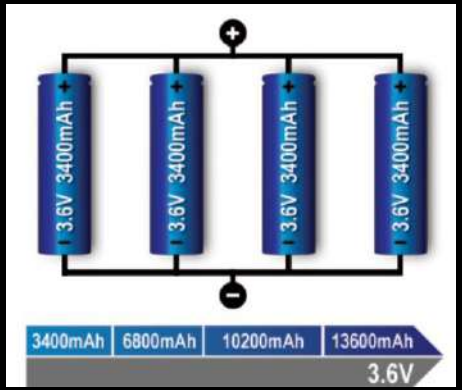
Chemicals source

It generates electricity through chemical reactions that occur within the source.

Basis of Difference	Cell	Battery
Definition	A cell is an active circuit element that converts chemical energy to produce electrical energy.	A battery is a collection of two or more cells connected together in a single unit and produces electrical energy by performing a chemical reaction.
Circuit symbol		
Types	Cells are of two types – primary cell and secondary cell.	Types of battery are: primary battery and secondary battery.
Service time period	Cell supplies electrical power for a short period of time.	Battery supplies electrical power to the circuit for a long duration.
Physical size	The size of a cell is small.	Battery is relatively larger in size.
Weight	Cell is light in weight.	Battery is heavy.
Cost	The cost of a cell is quite low.	Battery is relatively costlier.
Energy supplied	Cell can supply only small amount of energy for short time.	Battery can provide more amount of energy than a cell, because it consists of many cells in a single unit.
Examples	Dry cell, Daniel cell, electrolytic cell, fuel cell, galvanic cell, Leclanche cell, etc.	Li-Ion battery, lead-acid battery, Ni-Cd battery, etc.
Application	Cells are generally used in portable devices like clock, torch, toys, remote controls, etc.	Batteries are used in devices that demand more power to operate such as lamps, inverters, automobiles, emergency lights, etc.

Primary cells	**Secondary cells**
Cannot be recharged	Can be recharged
Alkaline	Nickel-cadmium
Lithium	


3.6V 3400mAh
3.6V 3400mAh
3.6V 3400mAh
3.6V 3400mAh
3.6V
7.2V
10.8V
14.4V
3400mAh


3.6V 3400mAh
3.6V 3400mAh
3.6V 3400mAh
3.6V 3400mAh
3400mAh
6800mAh
10200mAh
13600mAh
3.6V

Resistance (R) *Ω ohm*

Opposition to the flow of electrons.

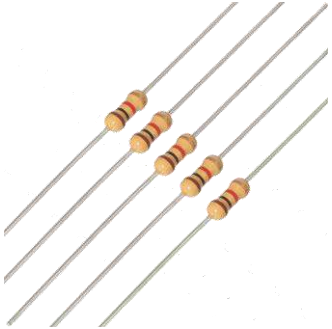
Mesure in Ohms – George Simon Ohm

Conductance$_{\text{material}}$

The ability of a material to pass electrons

$$R = \frac{1}{G} \quad \textbf{\textit{or}} \quad G = \frac{1}{R}$$

Resistors



Fixed Carbon

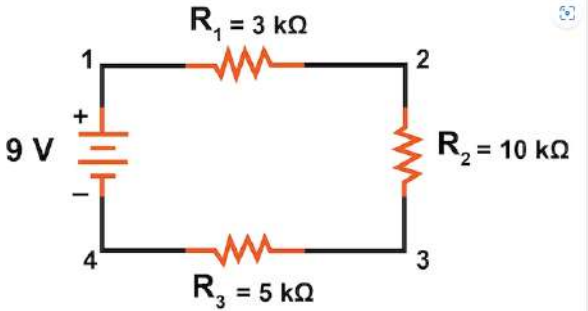
Variable Carbon

Fixed Wirewound

Circuit

Serie

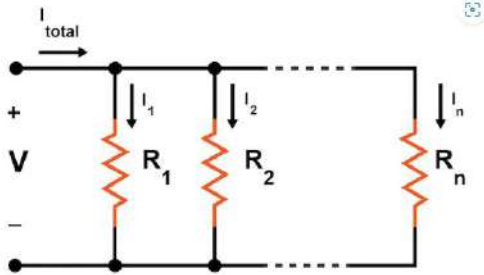
$$R_t = R_1 + R_2 + R_3 + R_n$$

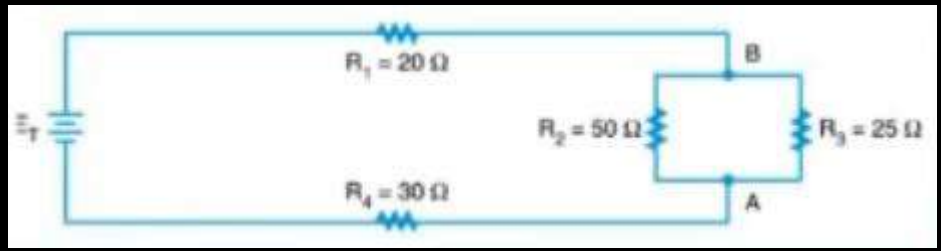


Parallel

$$R_t = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_n}}$$

$$R_t = \frac{R_1 * R_2}{R_1 + R_2}$$




$R_1 = 20\ \Omega$
B
$R_2 = 50\ \Omega$
$R_3 = 25\ \Omega$
$R_4 = 30\ \Omega$
A

Electric circuit

Ohms law

Electric circuit

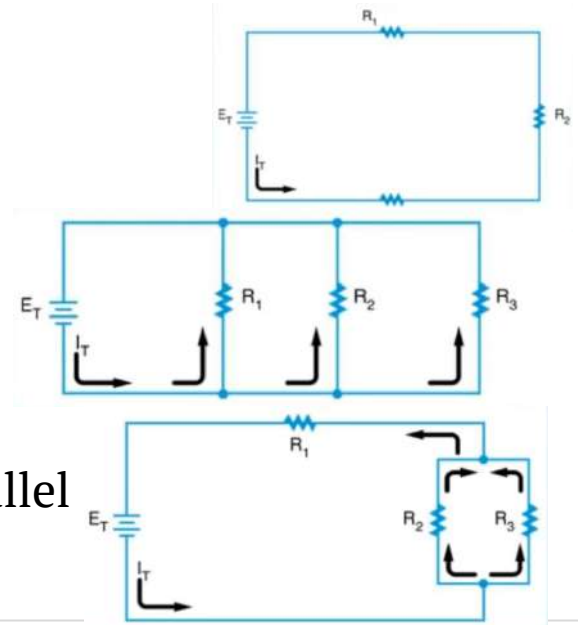
A voltage source – a load – a conductor.
The path that current follows is called an electric circuit

Three types of circuits

Series

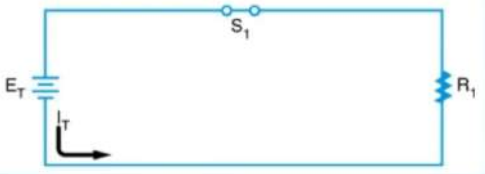
Parallel

Series-Parallel

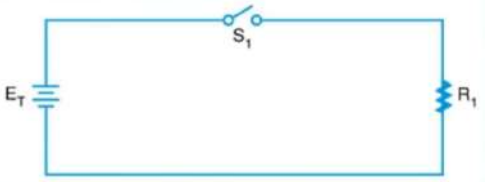


Two types of Flow

Closed circuit



Open circuit



Current Flow can be varied by

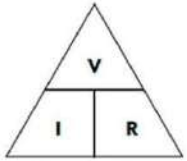
$$V = I * R$$

CAREER POWER
AN IIT/IIM ALUMNI COMPANY

Ohm's Law

$$I = \frac{V}{R}$$

Electric current = Voltage / Resistance



Ohm's law triangle

V = I x R
I = V / R
R = V / I

Ohms law

Serie

- The same **current** Flow throughout the circuit.

$$I_T = I_{R1} = I_{R2} = I_{R3}$$

- The total voltage is equal to the voltage drop across individual load.

$$V_T = V_{R1} + V_{R2} + V_{R3}$$

Parallel

- The same voltaje is applie to each Brand in the circuit

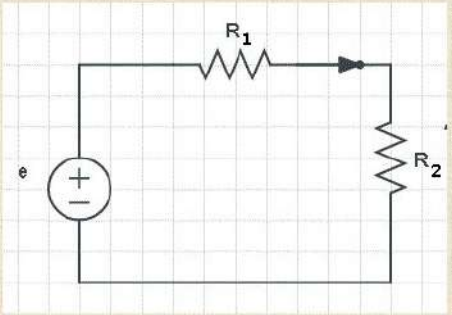
$$V_T = V_{R1} = V_{R2} = V_{R3}$$

- The total current is equal to the sum of individual Branch currents.

$$I_T = I_{R1} + I_{R2} + I_{R3}$$

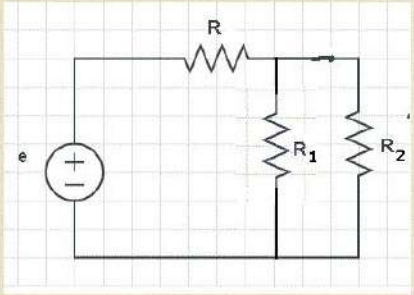
Example 2

In the circuit below resistors R1 and R2 are in series and have resistances of 5 Ω and 10 Ω, respectively. The voltage across resistor R1 is equal to 4 V. Find the current passing through resistor R2 and the voltage across the same resistor.



Example 3

In the circuit below resistors R1 and R2 are in parallel and have resistances of 8 Ω and 4 Ω, respectively. The current passing through R1 is 0.2 A. Find the voltage across resistor R2 and the current passing through the same resistor.



Many thanks

Questions ?

Oswaldo Andrés Ordóñez Bolaños