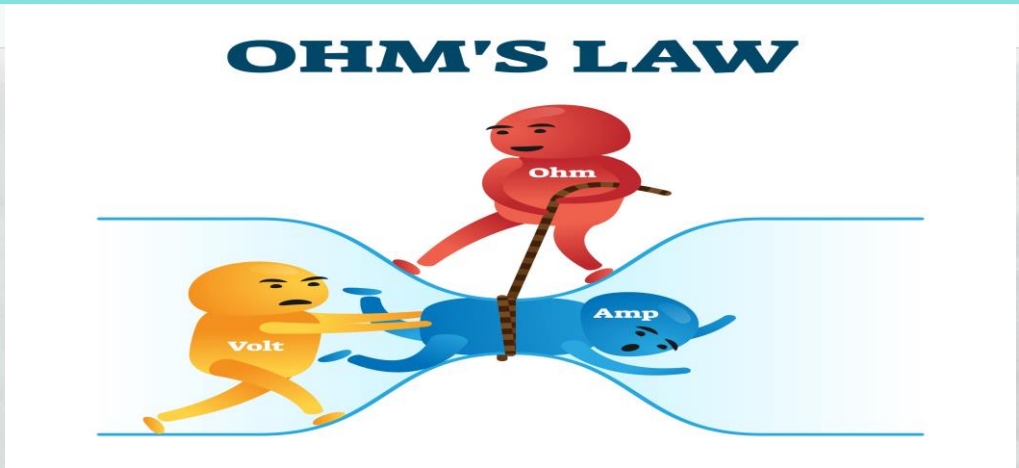
Hilla University Collage

Department of Prosthetics Dental Technology




# Lecture Two

## Ohm's Law

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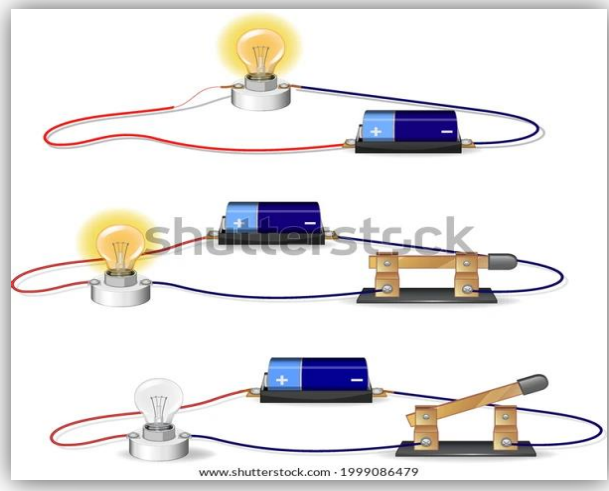
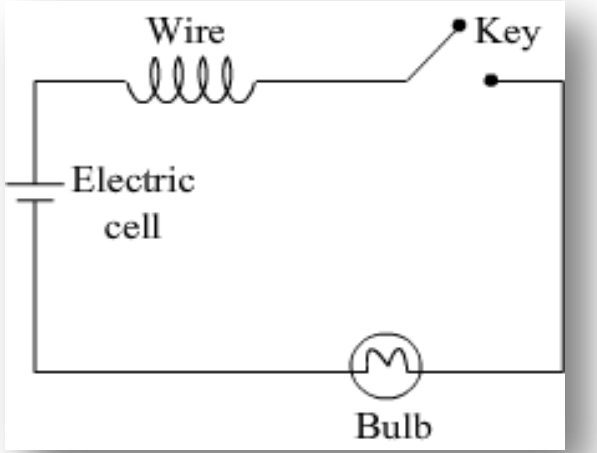
# Electric circuit

**Is path for transmitting electric current.**

## An electric circuit includes

- Device that gives energy to the charged particles that form the current ( battery or a generator).
- The connecting wires or transmission lines.
- A key (switch) to open and close the electrical circuit
- Devices that use current( lamps, radio).



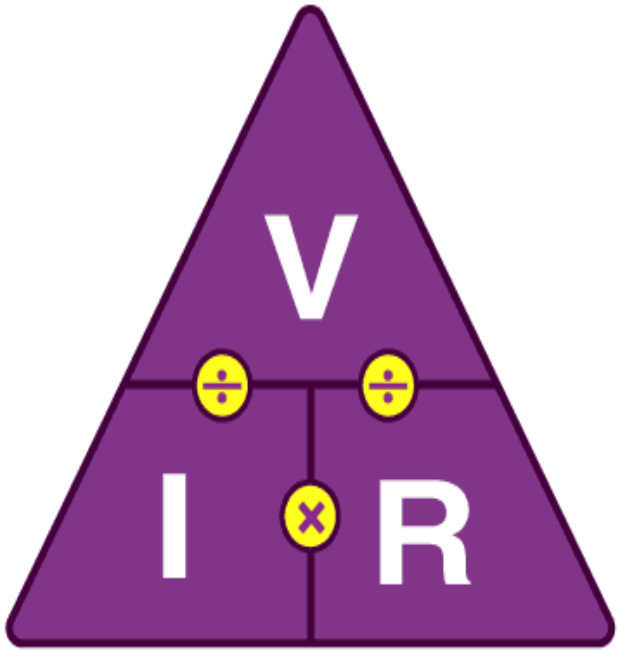



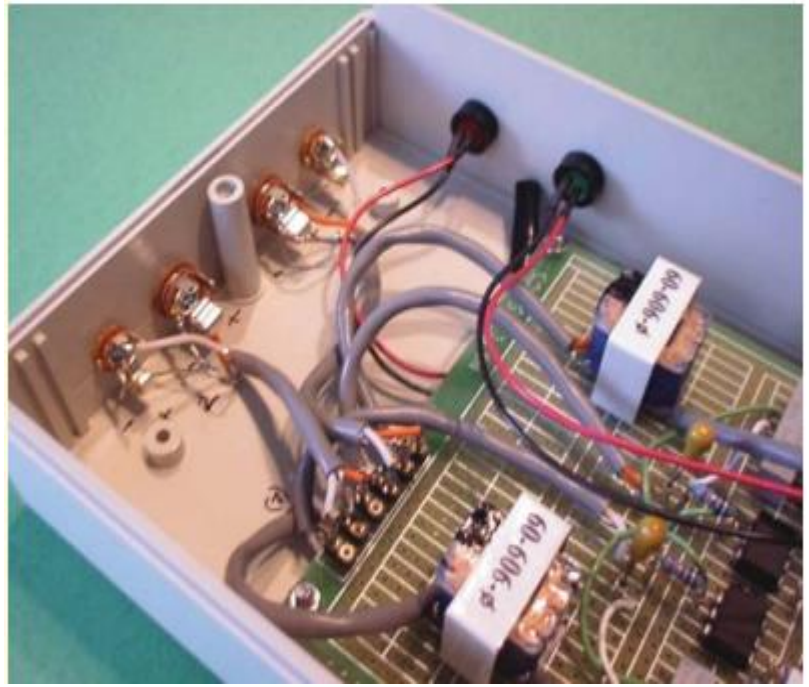

- The basic law that mathematically describe the performance of electric circuits is Ohm's law

# Ohm's law

Law states that current is proportional to the applied voltage and inversely proportional to the resistance.

Ohm's law defines the relationship between voltage, resistance and current. This law is widely employed while designing electronic circuits

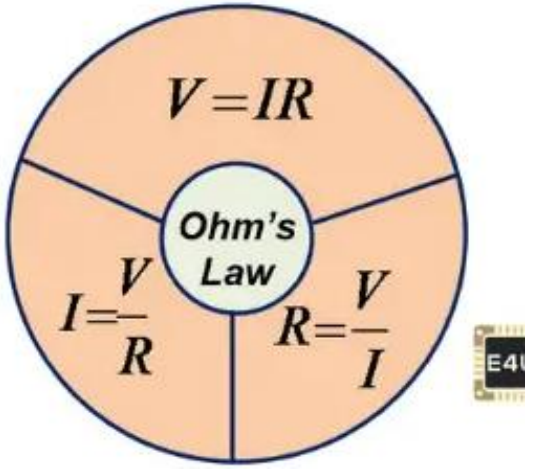


# Ohm's Law

**There are three forms of Ohm's Law**

- **I = V/R** **Current**
- **V = IR** **Voltage**
- **R = V/I** **Resistance**




**Current:**

is the number of charges ( C ) per unit time (sec) flowing out of a power source, past a point on a wire. $I = \frac{Q}{t}$ **with unit ampere (A)**

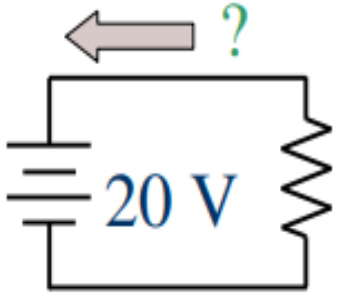
**Voltage:**

is the difference in electric potential (in volts) between two points in a circuit.

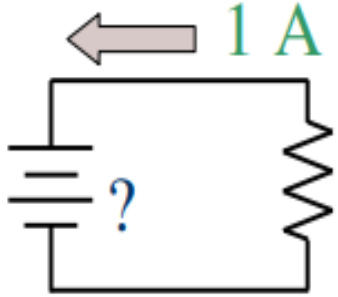
**Resistance:**

is the proportionality constant between the voltage *V* and the current *I* (in ohm, Ω)

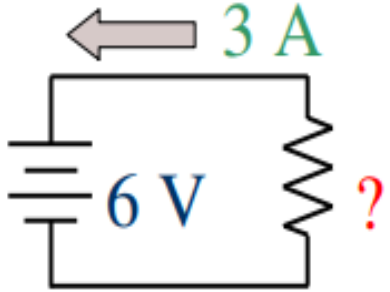
# Applying Ohm's Law


$$I = \frac{20\ V}{4\ \Omega} = 5\ A$$



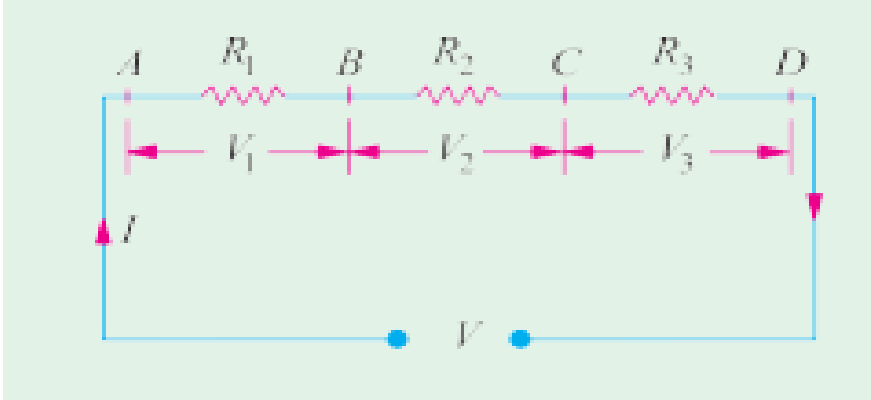

$$V = 1A \times 12\ \Omega = 12\ V$$



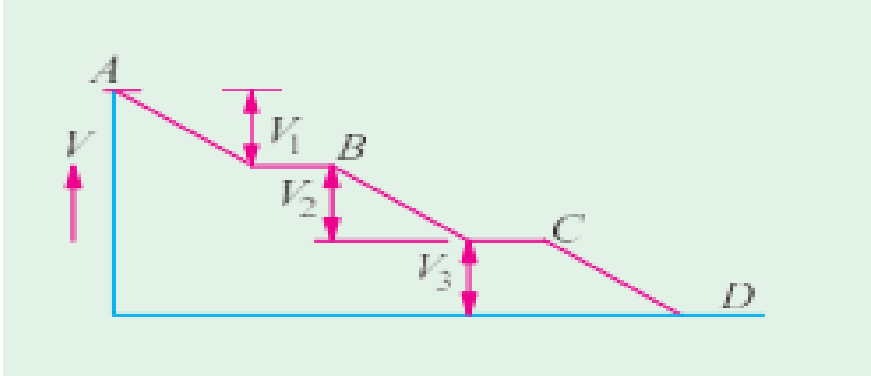

$$R = \frac{6\ V}{3\ A} = 2\ \Omega$$

# The Resistance in Series

When some conductors having resistances $\mathbf{R_1}$, $\mathbf{R_2}$ and $\mathbf{R_3}$ etc. are joined end-on-end as in Fig. It can be proved that the equivalent resistance or total resistance between points A and D is equal to the sum of the three individual resistances.




There is a progressive fall in potential as we go from point A to D as shown in Fig.



# The series connection

## The main characteristics of a series circuit are :

1. Same current flows through all parts of the circuit.

$$I_{total} = I_1 = I_2 = I_3$$

2. Different resistors have their individual voltage drops. ( Ohm's Law )

$$V_1 = IR_1 \qquad V_2 = IR_2 \qquad V_3 = IR_3$$

3. Applied voltage equals the sum of different voltage drops.

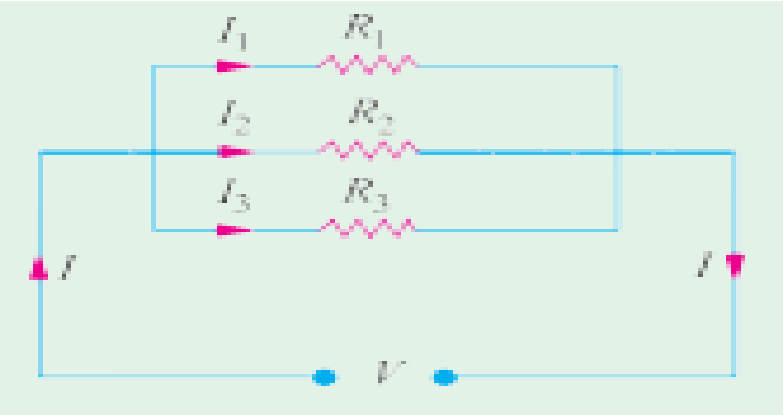
$$V_{total} = V_1 + V_2 + V_3$$

4. The equivalent (total ) resistance is equal to the sum of the three individual resistances:

$$R_{eq} = R_1 + R_2 + R_3$$

# The Resistances in Parallel

Three resistances, as joined in Fig. below, are said to be connected in parallel.




## The main characteristics of a parallel circuit are :

1. Same voltage acts across all parts of the circuit $V_{total} = V_1 = V_2 = V_3$

2. Current in each resistor is different and is given by Ohm's Law.

$I_1 = V/R_1$ $I_2 = V/R_2$ $I_3 = V/R_3$

3. The total current is the sum of the three separate currents.

$$I_{total} = I_1 + I_2 + I_3$$

4. $$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

# The electric power

## Is a rate of work done (energy conversion).

A large motor has more power than a smaller motor because it has the ability to convert more electrical energy into mechanical energy in the same period of time.

Power is determined by:

$$P = \frac{W}{t} \quad \text{with unit (W)}$$

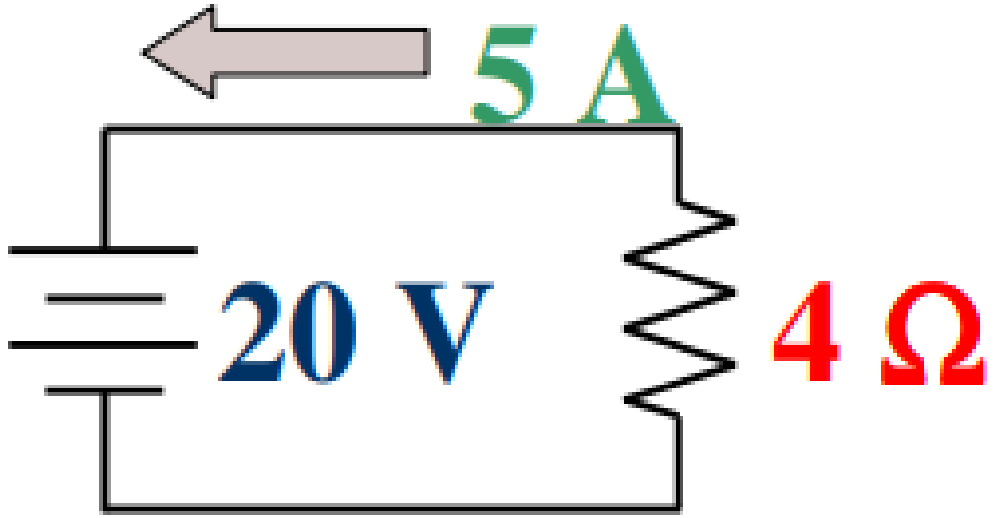
The amount of power dissipated in a resistance may be calculated using any one of three formulas, depending on which factors are known:

$$P = I^2R$$

$$P = V^2 / R$$

$$P = VI$$

# Applying Power Formulas

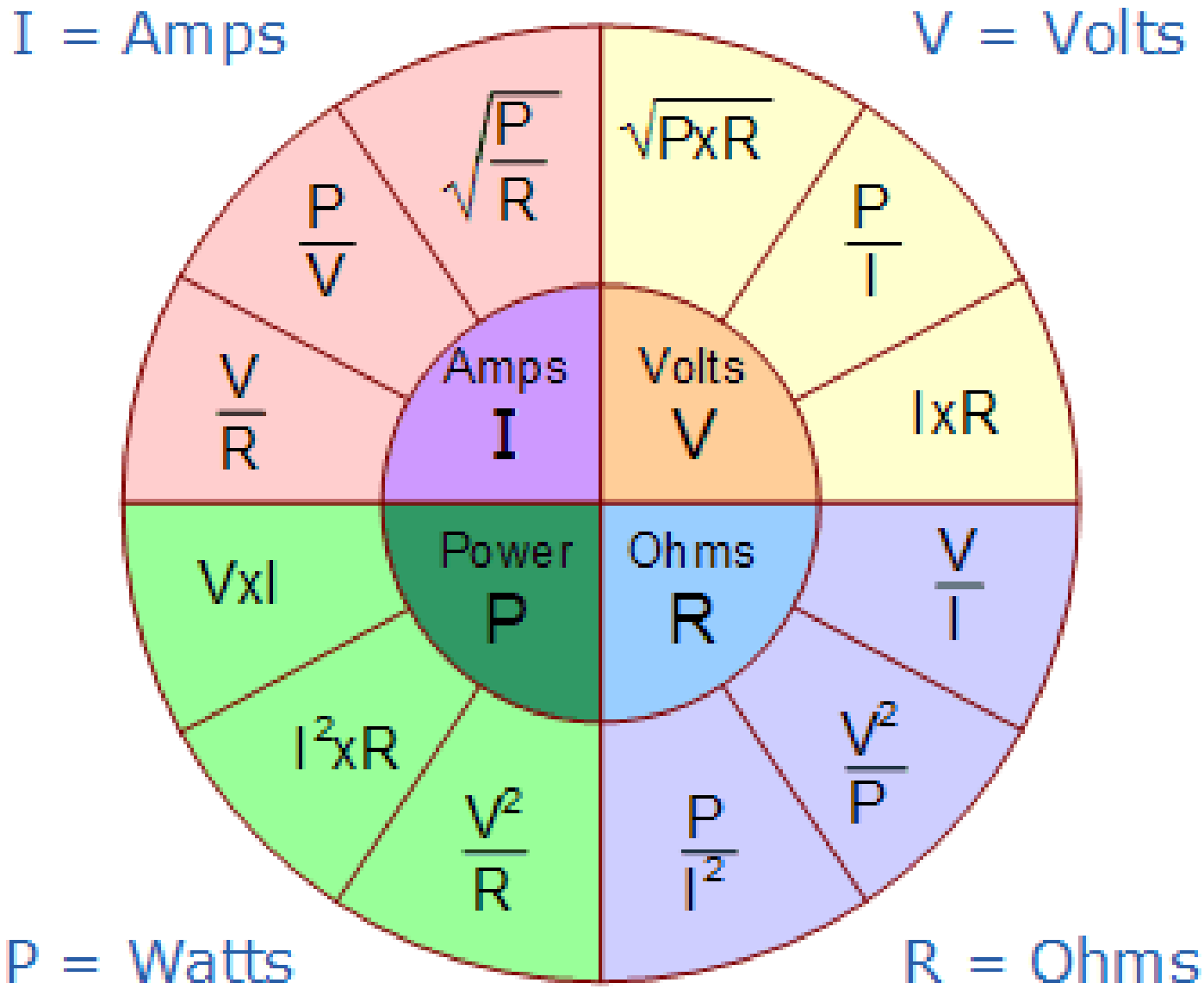



$P = I^2R$ = $(5)^2$ x 4 = 25 x 4 = 100 W

$P = V^2 / R$ = $(20)^2$ /4 = 400/4 = 100 W

$P = VI$ = 20 x 5 = 100 W

# Summary


I = Amps
V = Volts
P = Watts
R = Ohms
Amps
I
Volts
V
Power
P
Ohms
R
P/V
√(P/R)
√(PxR)
P/I
IxR
V/R
Vxl
I²xR
V²/R
P/I²
V²/P
V/I

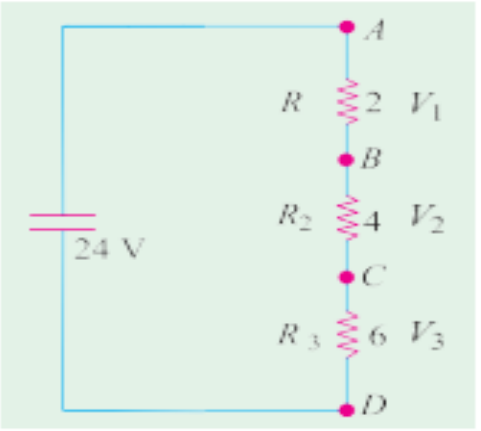
# Questions

1. From the electric circuit, find

(a) equivalent resistance.

(b) the total current.

(c) electric potential for each resista.

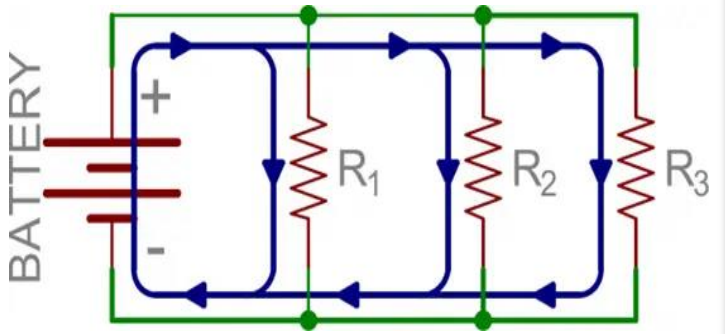



2. In the figure. three resistance ***( $R_1$= 6 Ω, $R_2$= 9 Ω, $R_3$= 18 Ω )*** connected in parallel, and the equivalent resistance connected with a battery ***(18 v)***, calculate.

(a) the equivalent resistance.

(b) the current in each resistance.

(c) the total current.




THANK YOU FOR LISTENING