SNS COLLEGE OF TECHNOLOGY
Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB101 – CIRCUIT ANALYSIS AND DEVICES

I YEAR/ II SEMESTER

UNIT 1 – MESH AND NODE ANALYSIS OF ELECTRIC CIRCUITS

TOPIC - Ohms Law

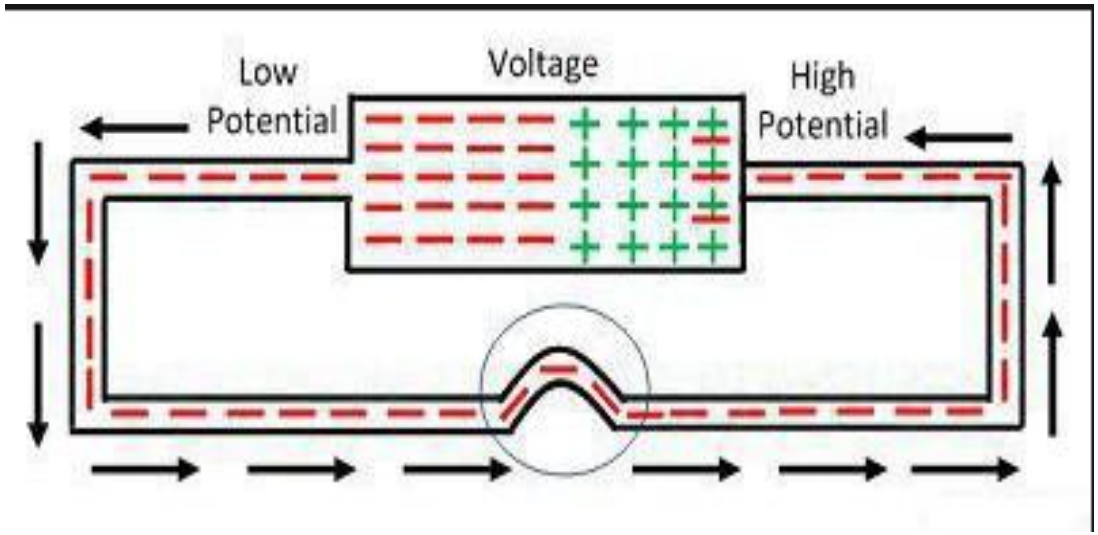
Introduction

- Electric Circuit : It is an interconnection of various elements in which there is at least one closed path in which current can flow.

- Electric circuit consists of two types of elements i) active elements (or) sources
  ii) Passive elements (or) sinks

Introduction

- Active Elements: Elements of a circuit which possess energy of their own and can impart it to other elements of the circuit.
- Two types of active elements: voltage source & current source.



Current is the rate at which electric charge flows past a point in a circuit. In other words, **current** is the rate of flow of electric charge.

Voltage, also called electromotive force, is the potential difference in charge between two points in an electrical field.

Introduction

- A **current source** is an electronic circuit that delivers or absorbs an electric **current** which is independent of the **voltage** across it.
- A **current source** is the dual of a **voltage source**.
- A **voltage source** is a two terminal device which can maintain a fixed **voltage**.

Introduction

- **Passive Elements:** Elements of a circuit which do not possess energy of their own.
- The passive elements are the resistance, the inductance and the capacitance.

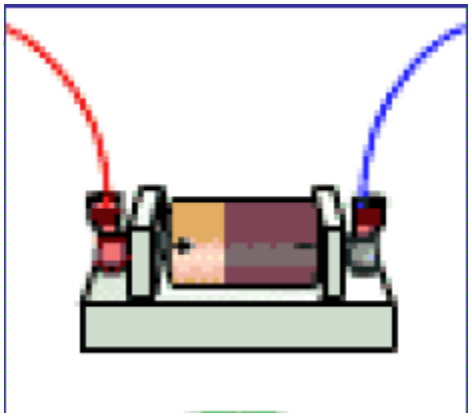
- **Resistance:** It's the property of a conductor by virtue of which, it opposes or limits the flow of current through it. The unit of resistance is ohm.

Resistors

- A *resistor* is a circuit element that dissipates electrical energy (usually as heat)
- Real-world devices that are modeled by resistors: incandescent light bulbs, heating elements (stoves, heaters, etc.), long wires
- Resistance is measured in Ohms

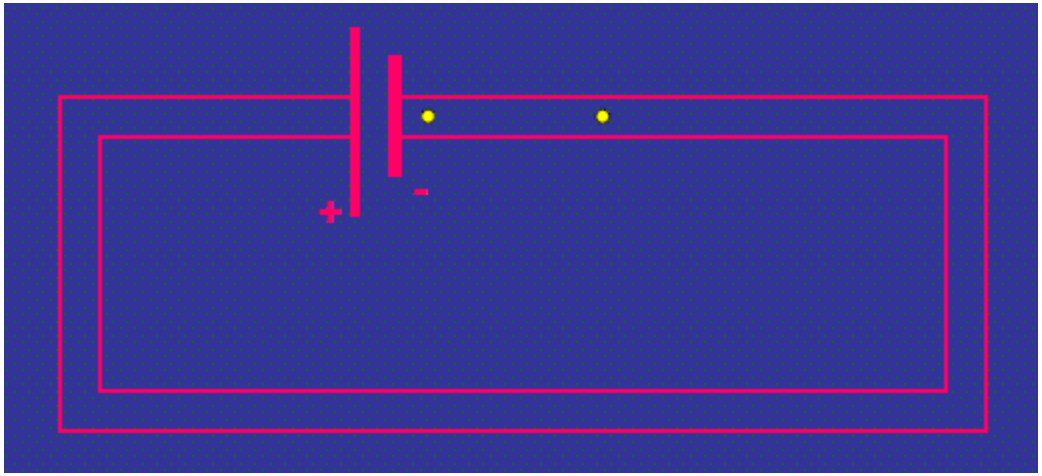
The CELL

- The cell stores **chemical energy and transfers it to** electrical energy when a circuit is connected.
- When two or more cells are connected together we call this a **Battery.**
- The cells' chemical energy is used up pushing a current round a



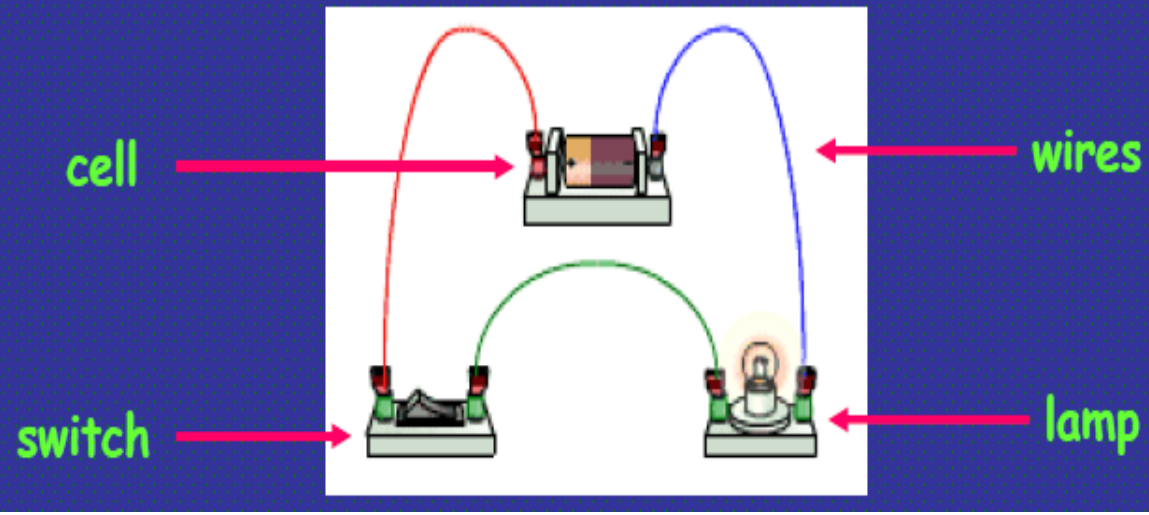
- In which direction does the current flow?

  from the **Negative terminal to the Positive terminal of a** cell.



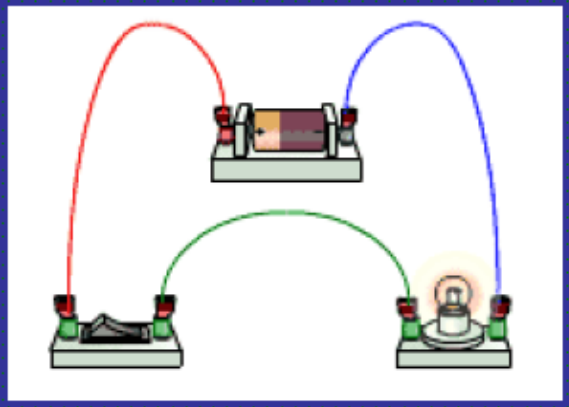
simple circuits

Here is a simple electric circuit. It has a cell, a lamp and a switch.



simple circuits

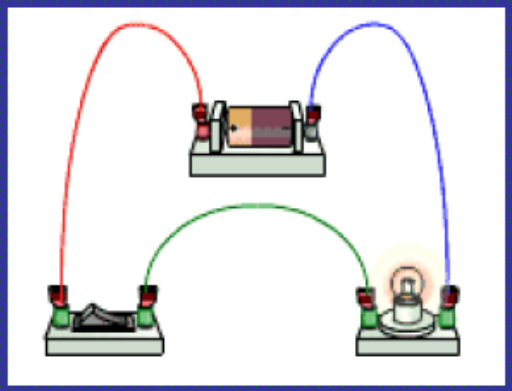
When the switch is closed, the lamp lights up. This is because there is a continuous path of metal for the **electric current** to flow around.

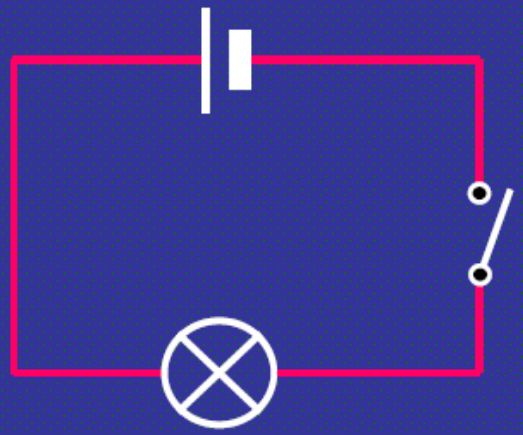


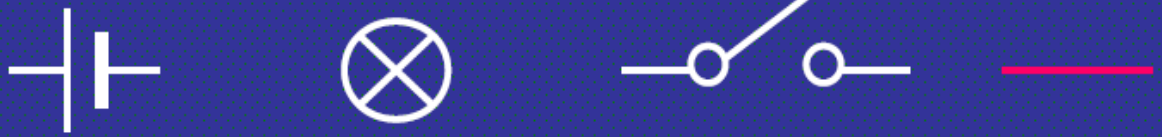
If there were any breaks in the circuit, the current could not flow.

circuit diagram

Scientists usually draw electric circuits using symbols;



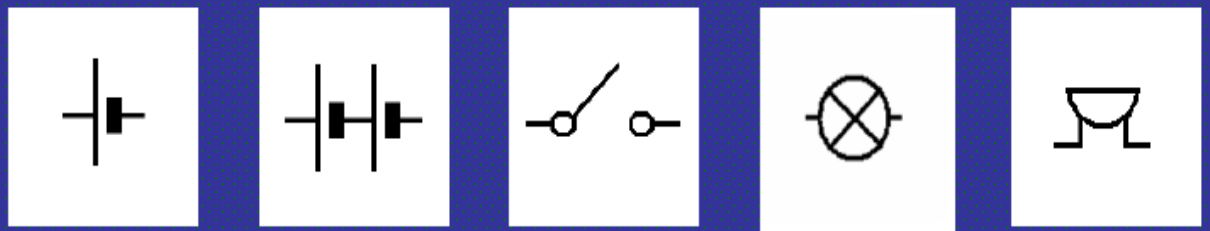




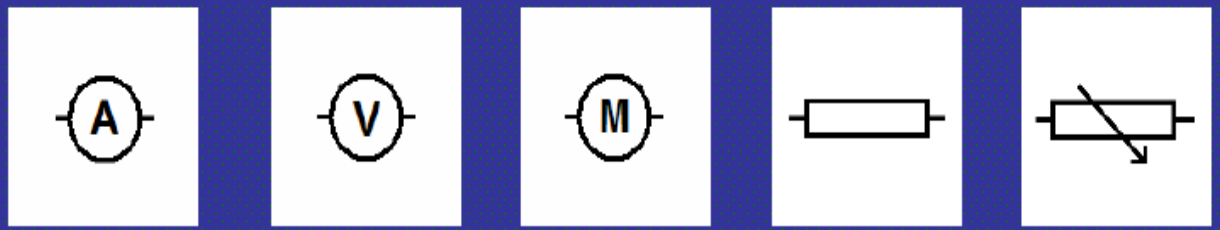
cell lamp switch wires

circuit diagrams

In circuit diagrams components are represented by the following symbols;



cell battery switch lamp buzzer



ammeter voltmeter motor resistor variable

Ohm's Law

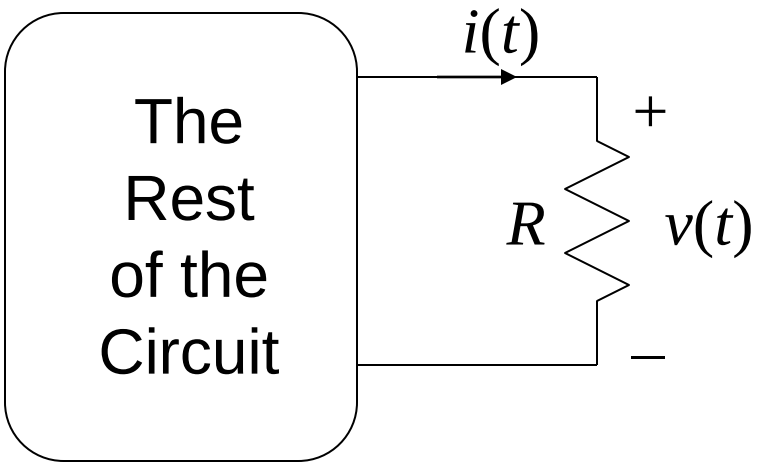
- German physicist, **Georg Simon Ohm**, who published a pamphlet in 1827 that described the measure of currents and voltages, and to describe and relate them mathematically.
- One result was a statement of the fundamental relationship we now call ***Ohm's law.***
- Ohm's law states that the voltage across conducting materials is directly proportional to the current flowing through the material, or

$$v = Ri$$

where the constant of proportionality R is called the r**esistance**.

Ohm's Law

- $v(t) = i(t)\,R$ - or - $V = I\,R$



Ohm’s Law

The temperature remaining constant, the current flowing through any conductor is directly proportional to the potential difference between the two ends of the conductor.

$$I \alpha V, \text{ when temperature is constant}$$

$$I = V / R$$

R is the resistance of the conductor

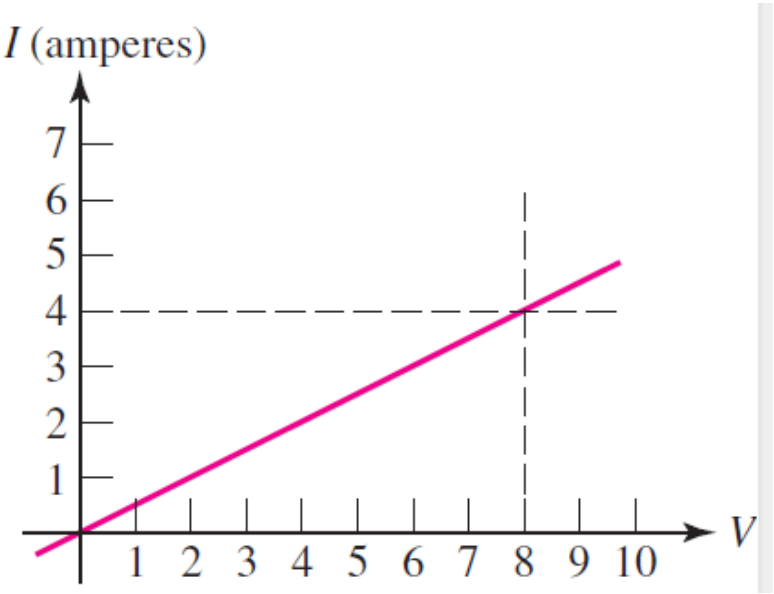
Ohm’s law can be applied for both a.c and d.c circuits.

Limitations of Ohm's Law

- Ohm's law does not hold good for non metallic conductors such as silicon carbide.
- Ohm's law also does not hold good for non linear devices such as zener diodes, voltage regulators etc.

Resistance

- The unit of resistance is the *ohm*, which is 1 V/A and customarily abbreviated by a capital omega, Ω.
- Resistance is normally considered to be a positive quantity, although negative resistances may be simulated with special circuitry.



Current-voltage relationship for an example 2 Ω *linear resistor.*

Power Absorption

- the *product of v and i* gives the power absorbed by the resistor.
- That is, *v and i are selected to* satisfy the passive sign convention.
- The absorbed power appears physically as heat and/or light and is always *positive*.
- A (positive) resistor is a passive element that cannot deliver power or store energy.
- Alternative expressions for the absorbed power are

$$p = vi = i^2R = v^2/R$$


THANK YOU