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. مقاطع فيديوهات لشرح المقرر بشكل وافي
. ملخص للمادة Pdf للمذكرة والمراجعة
. محاضرات مباشرة علي برنامج زووم
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ONLINE COURSES

Basics of Electrical Circuits

Lecture Topics

Lecture covers:

- System of Units.
- Basic Electrical Quantities:
  - Current.
  - Voltage.
  - Resistor.
  - Power.
- Simple Circuit elements.
- Introduction to Ohm law.
- Sign Convention.
- law of conservation of energy.

الطول متر m
الزمن ثانية s

نظام الوحدات

System of Units

2000m = 2 km
0.02m = 2 cm

The derived units commonly used in electric circuit theory

Quantity	Unit	Symbol
electric charge	coulomb	C
electric potential	volt	V
resistance	ohm	Ω
conductance	siemens	S
inductance	henry	H
capacitance	farad	F
frequency	hertz	Hz
force	newton	N
energy, work	joule	J
power	watt	W
magnetic flux	weber	Wb
magnetic fiux density	tesla	T

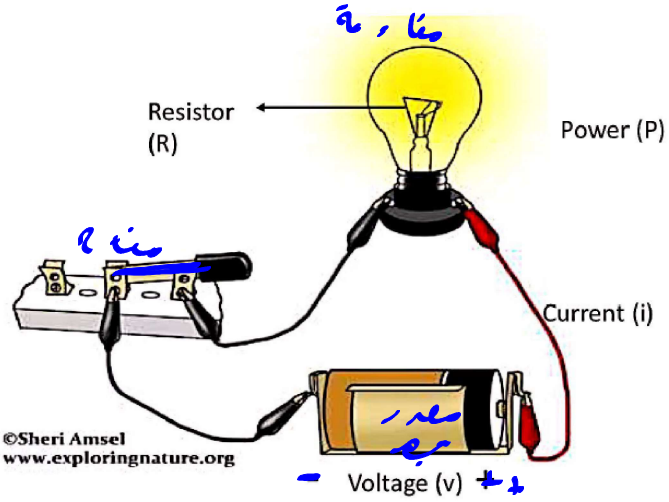
حفظ

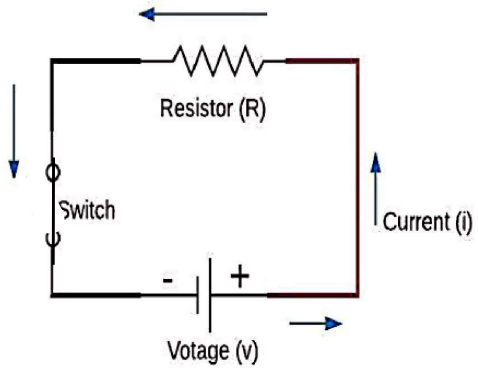
Factor	Prefix	Symbol
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

الكميات الكهربائية الاساسية

Basic Electrical Quantities

Basic electric quantities are current, voltage, resistor and power.





Electrical Circuit Diagram

Electric Current (i)

Current (i): is the movement of charge in specified direction or is the rate of change of electrical charge with respect to time, measured in Ampere.

$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$

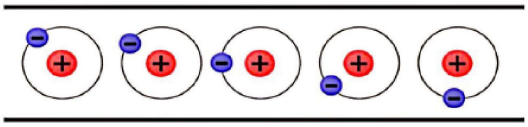
Or

$$I = \frac{Q}{t}$$ c/s

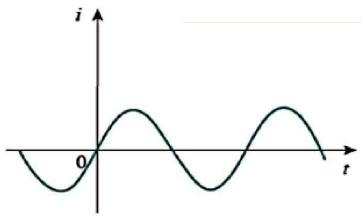
Where:
I = Current in Amperes (A)
Q = Charge in Coulombs (C)
t = time

The System International unit for current is the Ampere (A), where

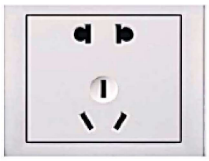
$$1\ A = 1\ \frac{C}{s}$$



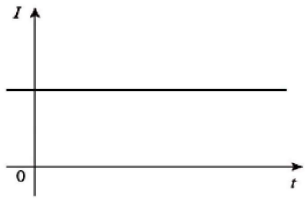
1Coulombs = 1.602×10^{19} Electron charge



Alternative Current (AC) is a current that varies sinuously with time.



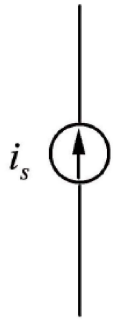
AC 9 → 12



Direct Current (DC) is a current that remines constant with time.

1 → 8

DC



Current source symbol

Voltage (Electric Potential Difference)

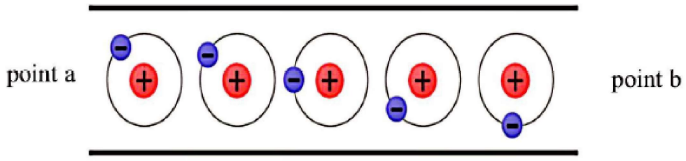
Voltage (potential difference) is the energy required to move one coulomb of charge form point **a** to point **b.**

$$\text{Voltage} = \frac{Work}{Charge} \text{ or } V = \frac{W}{Q}$$

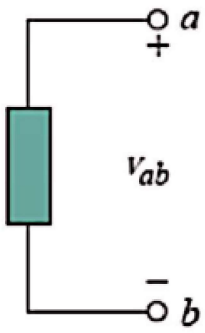
Where:
V= potential Difference (Voltage)
W= Work done
Q= charge

The system international unit for Voltage is volt (v),where

$$1v = 1\ \frac{Joule}{Coulomb}$$



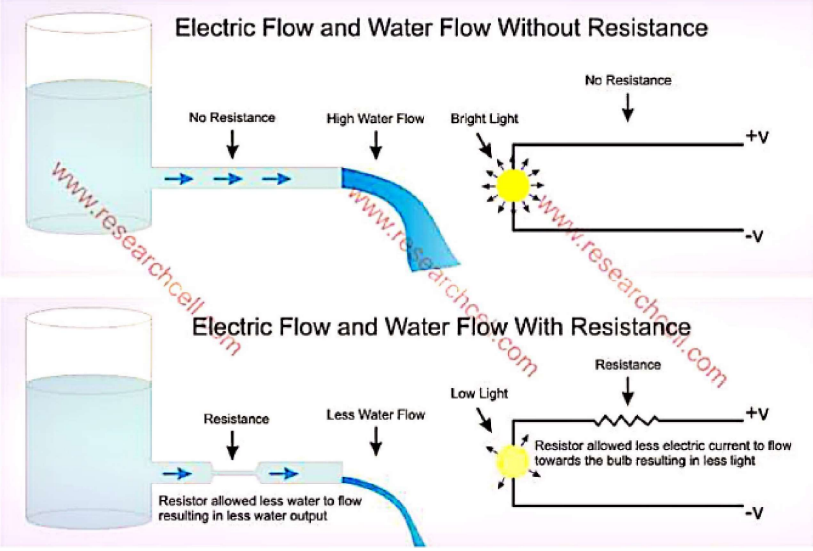
- As stated before , to move the electron in a conductor in a particular direction requires some work or energy transfer.
- This work is performed by an external electromotive force (emf)
- This emf is also known as *voltage* or *potential difference*.
- The voltage v_{ab} between two points *a* and *b* in an electric circuit is the energy (or work) needed to move a unit charge from *a* to *b*.



- To move charge *q* from point *a* to point *b* requires−30 J. Find the voltage drop between points a and b If: $V = \frac{W}{q}$, $-30J$
  (a) $q = 2$ C. $V = \frac{-30J}{2C} = -15\ V$
  (b) $q = -6$ C . $V = \frac{+30J}{+6C} = 5\ V$

Resistors

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



$$Resistor = \frac{Voltage}{Current}$$

or

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

Where the units are:

R= resistor in Ohm (Ω).
V= Voltage on Volt (V)
I= Current in Amperes (A)

Electric Power

The power is defined as the work done per unit time. Thus, the power, *P*, either generated or dissipated by a circuit element can be represented by the following relationship:

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Work}}{\text{Charge}}\frac{\text{Charge}}{\text{Time}} = \text{Voltage} \times \text{Current} \qquad \boxed{P = VI}$$

It is easy to verify that the units of voltage (joules/coulomb) times current (coulombs/second) are indeed those of power (joules/second, or watts).

مكونات الدائرة الكهربية البسيطة

Simple Circuit elements

A circuit is composed of elements (DC voltage sources, DC current sources, resistors) and conductors (wires).

Example: