

## Unit (2)

### 1) Physical properties of the electric current

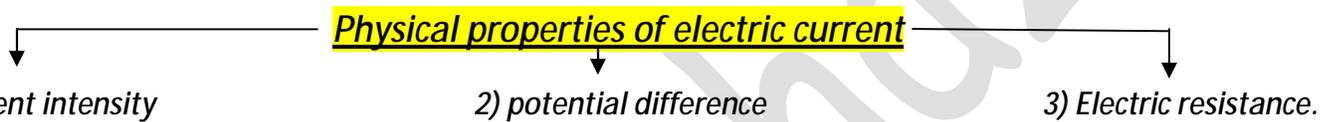
-We use electricity in all devices & it is generated from electric power stations.

-the atom is electrically neutral (protons (positive charges) inside nucleus equal to electrons (negative charges) around nucleus) bec. The attraction force between protons and electrons.

- (metal wire) conductor: it is the substance which has free electrons.

#### -Electric current:

it is the flow of electric negative charges (electrons) through a conductor.



#### 1- The electric current intensity:

It is the quantity of electric charges flowing through a cross section of a conductor in one second.

1)  $I = \frac{q}{t}$

2) Unit: Ampere =  $\frac{\text{Coulomb}}{\text{second}}$

3) Device: Ammeter is connected in series to a circuit.

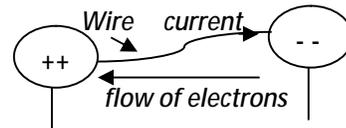
And it is symbol 

**\*Ampere:** it is the electric current intensity passing through a circuit when a charge of one coulomb passes in one second.

**\*Coulomb:** it is the charge when current passes in a conductor ampere in one second.

#### 2- The electric potential of a conductor:

It is the condition of electric conductor that shows the transfer of electricity to or from it when it is connected to another.



#### The potential difference across a conductor:

It is the work done to transfer a quantity of charge between two ends of this conductor.

1)  $V = \frac{w}{q}$

2) volt =  $\frac{\text{Joule}}{\text{Coulomb}}$

3-Device: Voltammeter is connected in parallel to a circuit.

And it is symbol 

**\*Volt:** It is the potential difference in a conductor on doing a work of joule to transfer quantity of one coulomb.

**\*Joule:** It is the amount of work done by a force of one Newton to move object through a distance of one meter.

### **\*The electromotive force (emf)**

It is equal to potential difference across two poles of electric source when circuit is open.

(No current passes through circuit).

It is unit: volt and Device: voltmeter.

### **3-The electric resistance (the resistor):**

It is the obstruction that the electric current face during it is movement through a conductor.

Measured by ohmmeter & it is unit ohm ( $\Omega$ ).

And its symbol.



### **\*the variable resistance (Rheostat):**

It is resistance which can be varied in order to control the current intensity & potential difference.

It is structure:

And its symbol.



A metallic wire around a cylinder, slider (thin plate) is fixed & has sliding contact moved along wire length.

-we move the slider on wire that can control current intensity if we increase the length of wire, increasing the resistance and decreasing electric current intensity & vice versa.

### **\*Ohm's law (the relation between current intensity & the potential difference):**

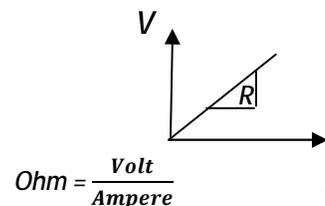
The electric current intensity passing through a conductor is directly proportional to the potential difference at constant temperature.

$$V \propto I$$

$$V = \text{Constant} \times I$$

$$V = RI$$

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



### **Resistance:**

It is the ratio between potential difference across two ends of conductor (resistor) & the electric current intensity passing through it.

**\*Ohm:** It is the resistance of conductor which allows passing one ampere of electric current intensity when the potential difference is one volt.

## 2) Electric current & cells

### \*some sources of electric current:

**1-Chemical reactions:** They change the chemical energy into electric energy.

It produces direct current.

**Ex:** Electro chemical cells (dry cells).

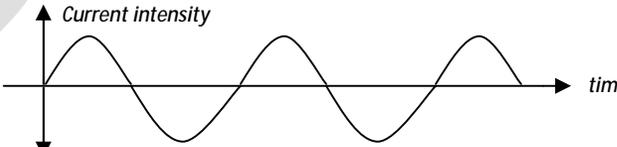
**2-Electric generator (Dynamo):** They change the kinetic (Mechanical) energy into electric energy.

Produce Alternating electric current.

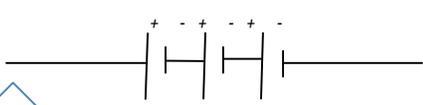
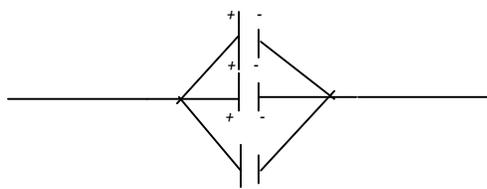
**Ex:** Dynamo (Electric generator).

Electricity in our homes comes from large power stations that contain dynamos, cables & wires carry it.

### Types of the electric current

1)-Direct electric current	2)-Alternating electric current
<p>1-it is unidirectional &amp; has Constant intensity.                      2-produced from electric cells                      3-cannot be changed into alternating current.                      4-it can be transmitted for long distances.                      5-it is used in electroplating                      And electrolysis processes</p>	<p>1-it is variable in both directions &amp; intensity                      2-produced from electric generator                      3-can be changed into a direct current.                      4-it cannot be transmitted long distances through wires .                      5-it is used in lighting, houses &amp; in operating electric appliances</p>
	

### Methods of connecting the cells

Series Connection	Parallel Connection
<p>1-It is connected positive pole of first cell to negative pole of Second by a copper wire.                      2-(emf) of a group of different cells  <math>E_{battery} = E_1 + E_2 + E_3 + \dots</math>                      Similar cells: <math>E_{battery} = n \times E_1</math>                      3-used to obtain high (em.f) intensity</p>	<p>1- it is connect positive poles of all cells together &amp; negative poles of all cells by a copper wire.                      2-group of similar cells  <math>E_{battery} = E_1</math>                      3-used to obtain low (e.m.f) or to increase Current</p>
	

### 3) Radioactivity & Nuclear energy

\*All elements consist of atom which contains nucleus that concentrated the mass of atom in it bec. It contains protons & neutrons that electrons rotate around it in energy levels & the atom is responsible for all physical & chemical properties of element.

\*Atom acted by a group of forces:

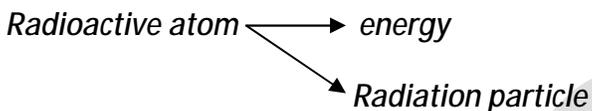
1-Repulsion force (electromagnetic forces) between protons.

2-Attractive force between neutrons and neutrons or protons and neutrons this strong attraction force is (nuclear force)

-the various forces are the source of (Nuclear energy) that stored in nucleus

-when nuclear reaction occur in nuclei the energy can be liberated from nuclei of atones.

\*Nuclear energy: It is an energy stored in nucleus.



\*isotopes: They are atoms of same element with different number of neutrons & same number of protons.

Ex: Radium – uranium – cesium.

\*radioactive elements: They are unstable elements whose atom's nuclei contain number of neutrons more than the number required for it is stability, so it has excess energy

\*Discovering the radioactivity phenomenon radioactive phenomenon:

It is the spontaneous conversion of nuclei of radioactive elements that are present in nature in an attempt to achieve a more stable composition.

- ✓ Radioactivity was discovered by Henri Becquerel (French scientist) in 1896, he discovered unseen ray from uranium element that can penetrates solid objects

#### Types of radioactivity

1-Natural radioactivity

-Radiation from natural radioactive elements present in nature.

Ex:

Rubidium – selenium –

Yttrium – zirconium – Strontium.

2-Artificial radioactivity

-Radiation or nuclear energy from nuclear plants.

Ex:

Nuclear reaction (nuclear reactors)

can be controlled (safe uses) -nuclear bombs(military uses).

## The safe uses of nuclear energy

1-Medical field: treat (diagnose) cancer.

2-Agricultural field: to eliminate pest & improve some plants.

3-industrial field: to convert sand to silicon sheets that used in manufacturing of computer processors & to discover defects in manufactured products.

4-Electrical generation field: used to heat water to produce steam which used to operate turbines to generate electricity.

5-Space exploration field: Radioactive materials are used as a nuclear fuel for rockets that fly in space.

6-Drilling field: for petroleum and underground water.

\*Dr. Aly Mustafa Mashrafa is Egyptian scientist is one of grates physicists in world he has great theories in fields of atom & radiation and the atomic bomb were based on his theories.

\*Radiation pollution: It is the increase of the amount of radiation in environment.

### 1-Natural radiation sources:

1-Natural radioactive materials found in earth.

2-Cosmic radiation comes from outer space.

### 2-Artificial radiation sources:

1-Nuclear bombs of countries do experiments from time to time.

2-Nuclear reactors.

#### Ex:

Explosion occurred in Russian reactor at Chernobyl as are salt of error in operation the radioactive elements produced from explosion formed atomic clouds that down (fall)rains

-plants & soil were polluted, cows & sheep ate plants, their milk & meat were affected by radiation like (iodine – cesium isotopes) in food that produced from decay of nuclear fuel (uranium235).

## The radiation effect on human body

### 1) Effect of exposure to a large dose of radiation a short time:

1-damage spleen.

2-damage digestive system.

3-damage nervous system.

4-damage bone marrow (it responsible for the formation of red blood cells): leads to feeling of being sick – sore throat – accompanied by nausea, vertigo & diarrhea.

## 2) Effect of exposure to small dose of radiation for a long time (month or years):

### 1-physical effects:

They are changes appear on living organisms after exposure to radiation.

### 2-Genetic effects:

Changes in sex chromosome composition which results in abnormal birth.

### 3-cellular effects:

Changes in cells composition lead to destroying cells chemical composition of hemoglobin changes so it becomes incapable of carrying oxygen.

\*measuring unit of radiation is (Ram), and maximum safe dose of nuclear radiation not exceed 5 Ram in one day.

### \*Protection from radiation pollution:

1-dont be exposed to nuclear radiation that maximum safe doses (5 ram in one day).

2-workers with radioactive elements in labs should wear radiation protective gloves & masks.

3-follow precautions with radioactive wastes away from underground water path, earth quakes, volcanoes & animals.

4-Nuclear wastes of weak & medium radiation (surrounded by cement layer & placed in ground) while strong radiation (cooled by water & placed in deeply buried in ground away from inhabited areas).

5-Establish lams for nuclear plants to cool the hot water before throwing in seas & lakes.