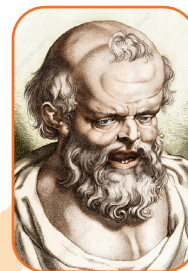
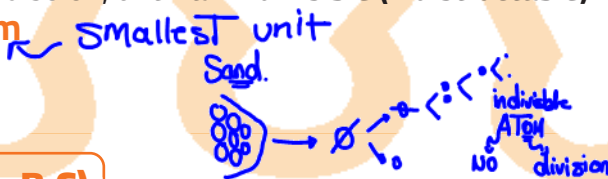


Evolution of concept of atomic structure

long time ago man wondered about the nature of matter and its structure?
through the trials done by the scientists to answer questions across different eras.
The concept of atomic structure is evolved.

Democritus's (Greek philosopher) idea:

He imagine the possibility of **dividing any piece of matter to smaller parts**, then dividing those parts into smaller and so on, until **an indivisible (indistructable)** fragement is obtained named **atom**.



Democritus

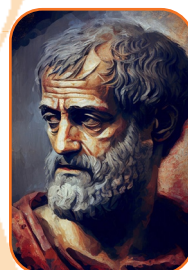
Aristotle's idea (4th century B.C)

- Reject former concept of atom and believed that matter whatever its **nature composed of 4 components which are water, air, dust and fire.**
- it was believed that **cheap metals like iron and copper can be changed to precious one like gold by changing the proportions of 4 constituents.**

GR This illogical idea blocked the development of chemistry

for more than 1000 yrs

Because The scientists were busy trying to changing cheap metals to precious ones.



Aristotle

Boyle's idea (1661):

Irish scientist Boyle reject Aristotle idea about nature.
Gave the **first element definition**

Element

pis

Pure simple substance that can't be changed to simpler forms by the traditional chemical methods.



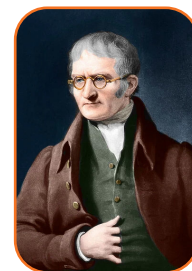
Boyle

Atomic Structure

Element \rightarrow 
Element

Dalton's model of the atom (1803):

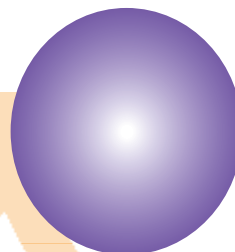
English scientist **John Dalton** stated the **first theory about the atomic structure**.



Dalton

The main postulates of Dalton's atomic theory:

- Element is composed of **very minute particle called atom**
- Atom is **indivisible solid particle**.
- Masses** of atoms of the same elements are similar but masses of different elements are different.
- The compounds are formed by the combination of atoms** of different elements in **simple numerical ratios**.



Dalton atom

Thomson's model of atom (1897):

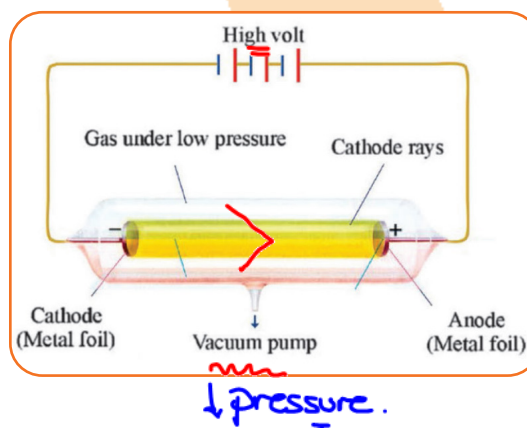
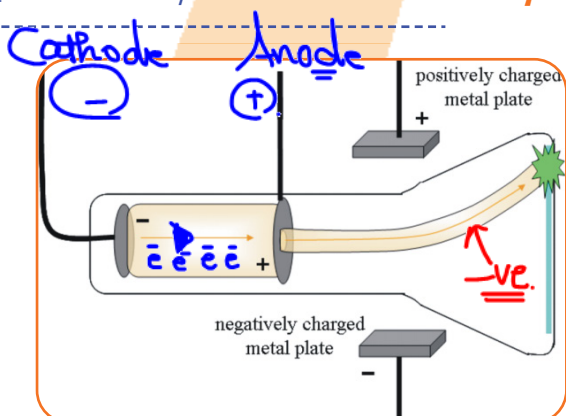
Thomson carried out many experiments on the **electric discharge through the gases**, from which he had discovered the **cathode rays**.

Discovery of cathode rays (1897)

- Gases don't conduct electricity under normal condition** of temperature and pressure.
- However **gases conduct electricity in a discharge tube** whose electrodes are connected to an electric source with suitable potential difference between its electrodes and **under very low pressure**.
- If the **potential difference between 2 electrodes increase to about 10,000 volts**, a **stream of invisible rays will be emitted from the cathode the negative electrode to the anode positive electrode causing fluorescent glow on hitting the tube wall** these rays named "**Cathode rays**".



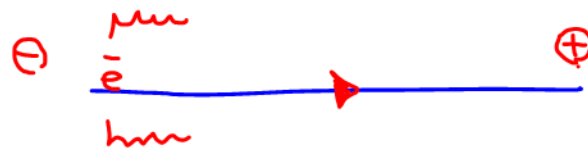
Thomson



Cathode rays

are streams of invisible rays emitted from the cathode of discharge tube in which the pressure of the gas is very low and the potential difference between the two electrodes is about 10,000 volts.

later known that these rays are composed of minute particle called "**Electrons**".



Properties of cathode rays

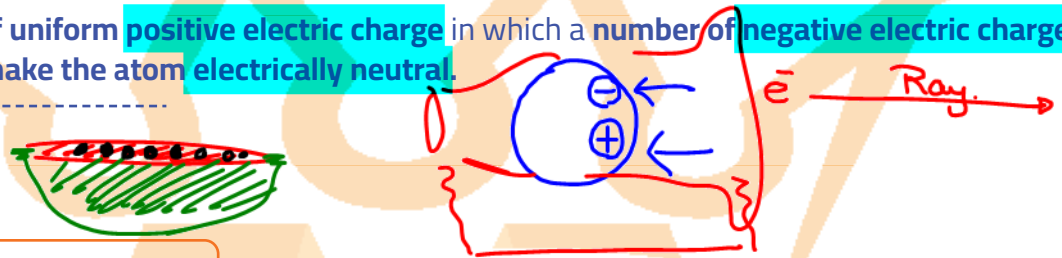
- Very minute negatively charged particles with negligible masses (Electrons)
- Moves in straight lines.
- Have a thermal effect. *دفاية*
- Affected by both electric and magnetic field.
- Don't vary with the nature of cathode material, or that of gas used, this is strong evidence that cathode rays are fundamental constituent of any matter.

مادى

matter Cathode = Electrons rays

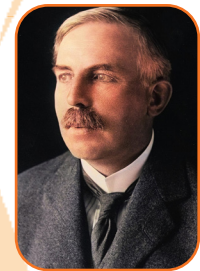
The Postulates of Thomson's model

- Atom is solid sphere of uniform positive electric charge in which a number of negative electric charges electrons embedded to make the atom electrically neutral.



Rutherford's model of atom (1911)

He is student of **Geiger** and **Marsden** had performed his famous laboratory experiment.



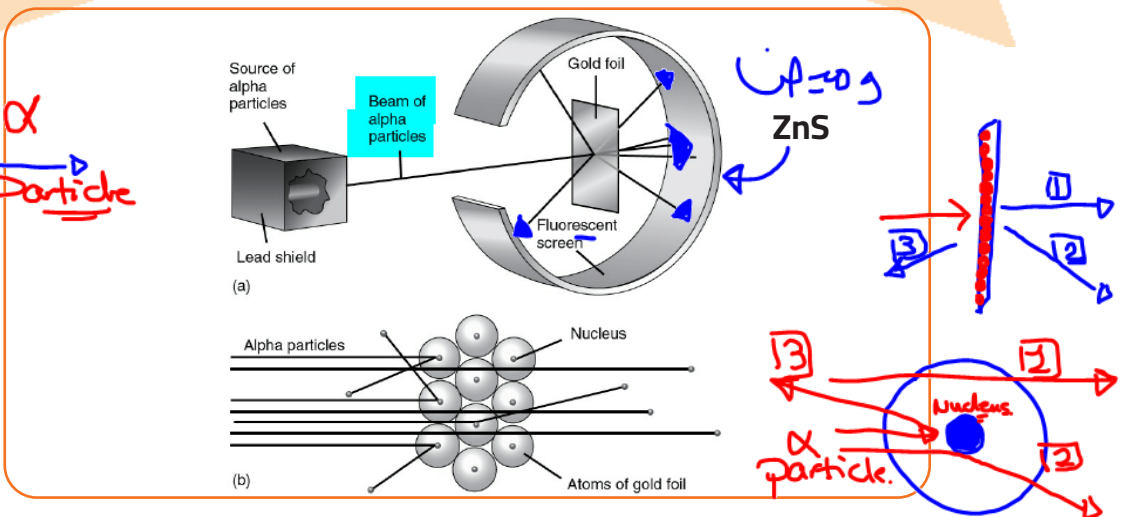
Rutherford

Rutherford's experiment:

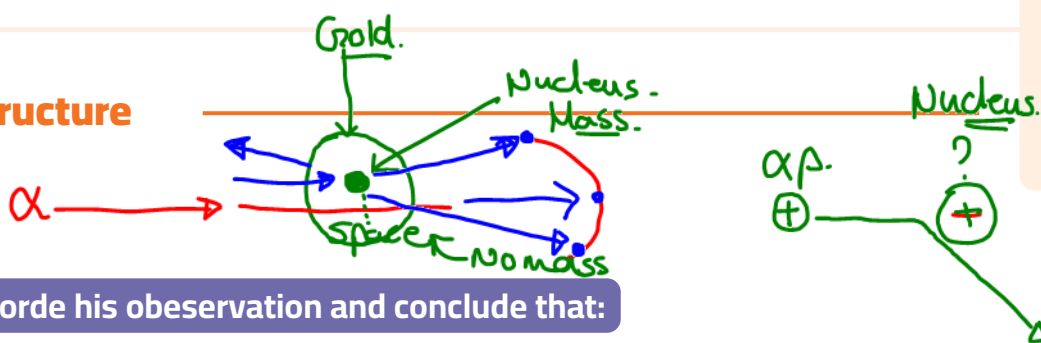
- A deep lead box contain a source of alpha particles inside it.
- A metal sheet lined with layer of zinc sulphide ZnS.
- A very thin gold foil.

The procedure:

- The Position alpha particles were allowed to colloide with the metal sheet where it was possible to define the location and the number of alpha particles by counting the flashes which appeared on the metal sheet. *(ZnS) zinc sulphide*
- A very thin gold foil was placed between the beam of alpha particles and the metal sheet. *Al₂O₃*



Atomic Structure



Rutherford records his observation and concludes that:

Observations	Explanations	Conclusions
Appearance of large number of flashes at the same position before the gold foil.	Penetration most of alpha particle without deflection.	Most of atomic volume is empty space. Not solid like Dalton and Thomson proposed.
Appearance of flashes on front of gold foil (on the other side of gold foil)	A very small percent of alpha particles didn't penetrate gold foil and bounce back (reflected). <i>مردود</i>	The atom contains a tiny part of very high density and most of atomic mass concentrated in called Nucleus
Appearance of some flashes on both sides of the position before replacing the gold foil.	A small fraction of alpha particles penetrate the gold foil but deflection from the path.	The dense part Nucleus has positive charge as alpha particles so alpha particles are repelled on approaching Nucleus. <i>دفع</i>

Based on his experiment and else, Rutherford designed the **first atomic model** on trial basis:

The postulates of Rutherford atomic theory:

1- Atom:

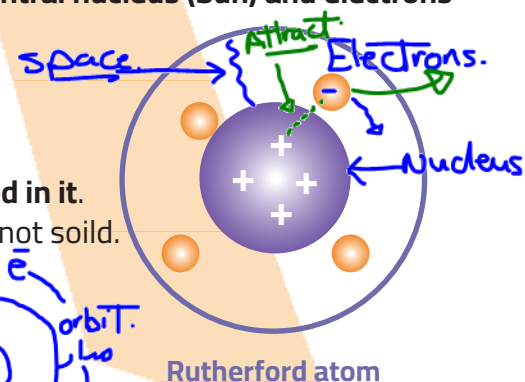
- Extremely **small size particle.**
- Complicated structure resembles the **solar system**, composed of **central nucleus (Sun) and electrons revolved around it (Planets).**

2- Nucleus:

- Much smaller than atom and most of atomic mass concentrated in it.**
- Vast space between Nucleus and orbits** of electrons so atom is not solid.
- Positively charged** *مثبت*

3- Electrons:

- Negligible mass** compared to nucleus.
- Negative charged** and **equal to positive charges** of nucleus so atom is electrically neutral.
- They travel around nucleus at a **tremendous speed** in special orbits, despite the mutual attraction between them and nucleus.
- Attraction force equal in quantity and opposite in the direction of the centrifugal force** result in **electrons revolved around the nucleus without fall in it.**



Drawback of Rutherford atomic model?

Failed to explain atomic structure.

Because it didn't explain the system in which electrons revolve around nucleus.