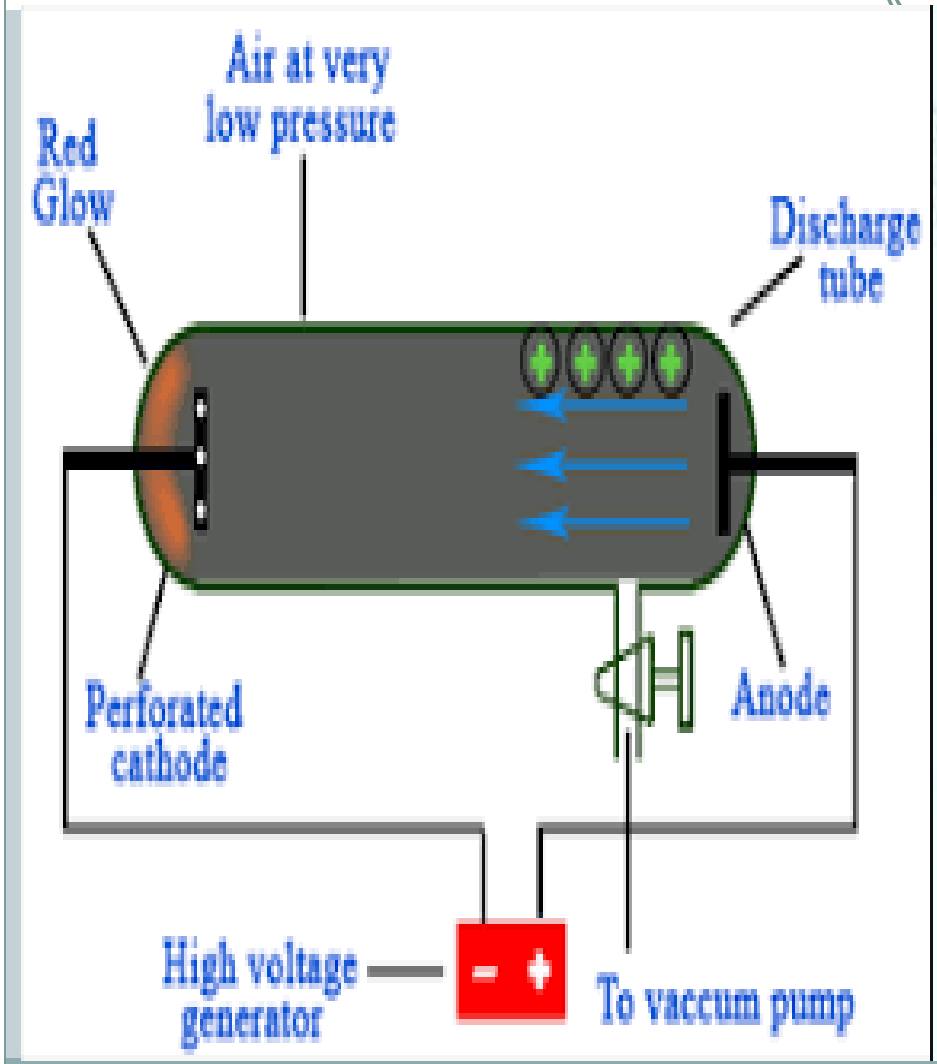
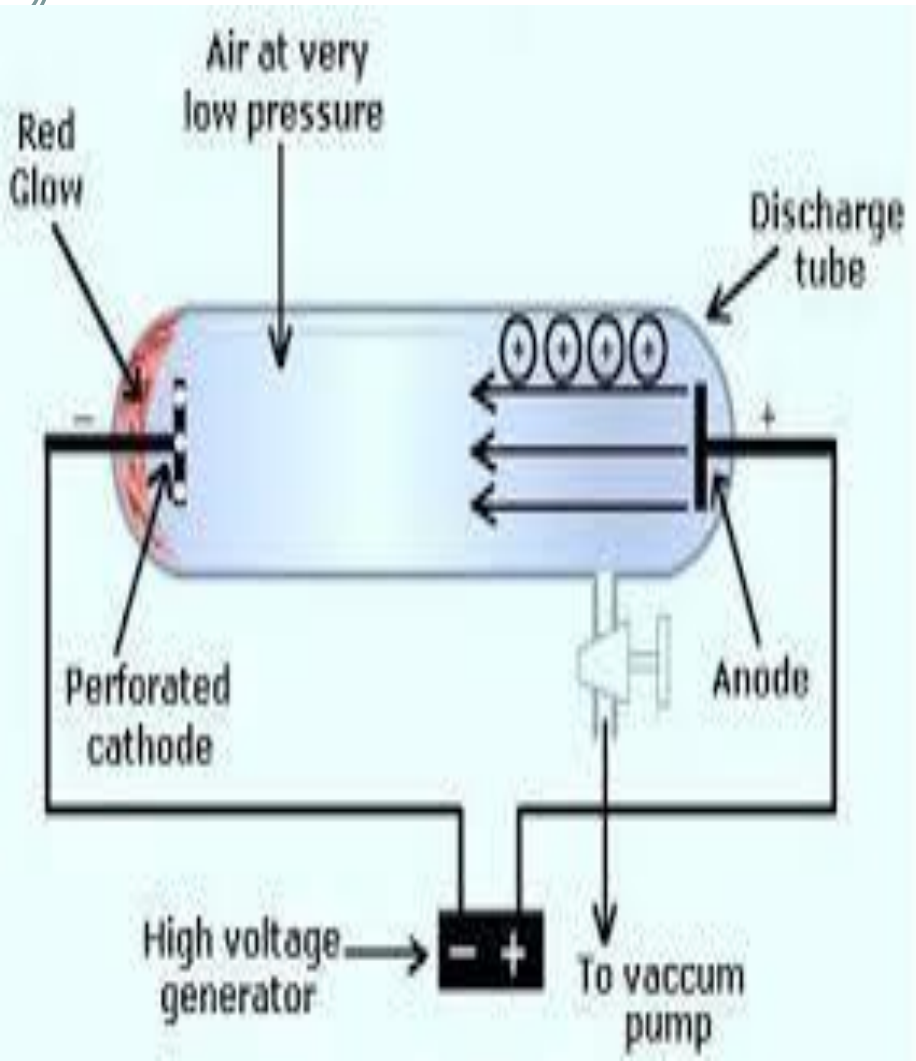
POINTS TO PONDER:

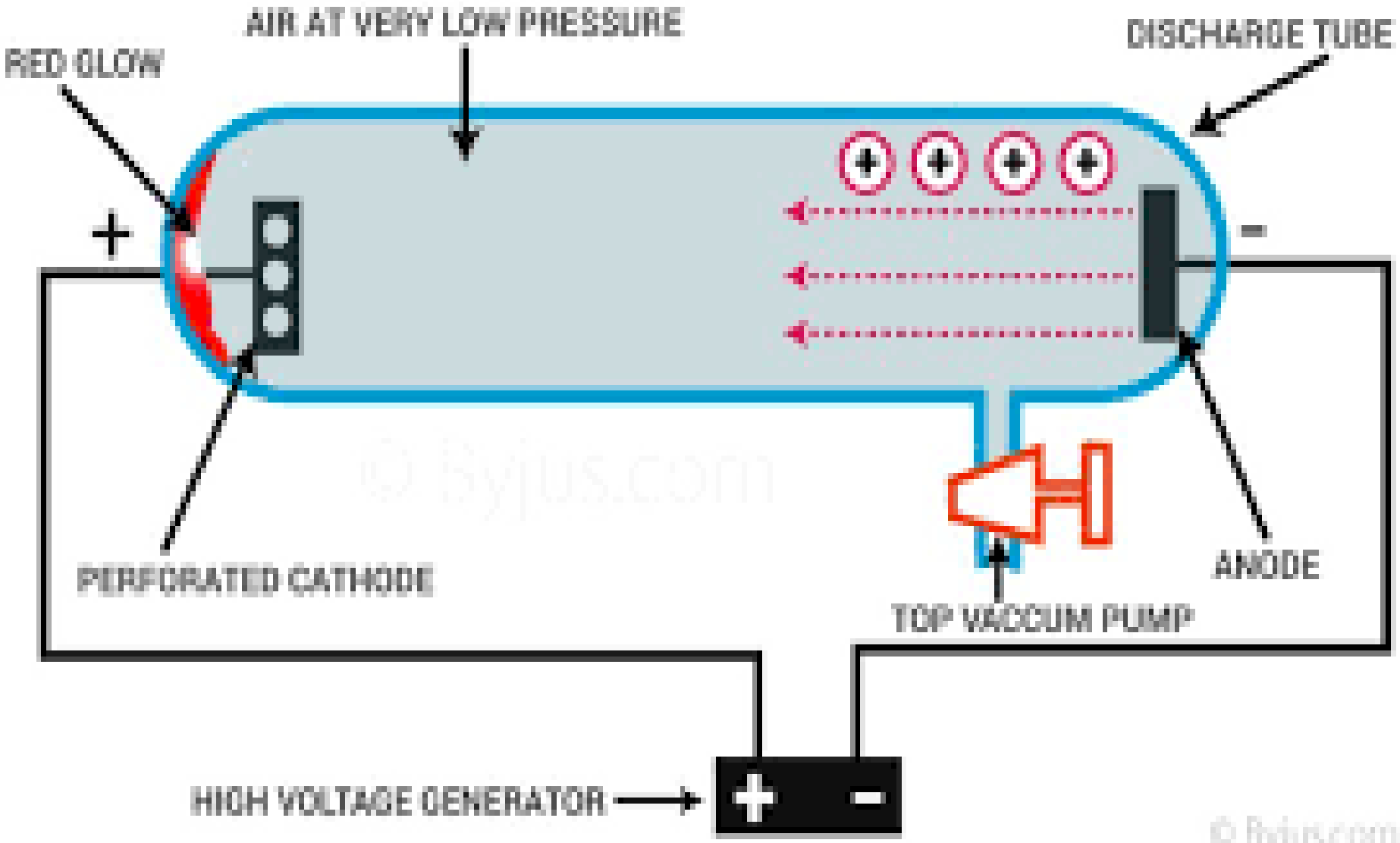




LESSON OBJECTIVES:5

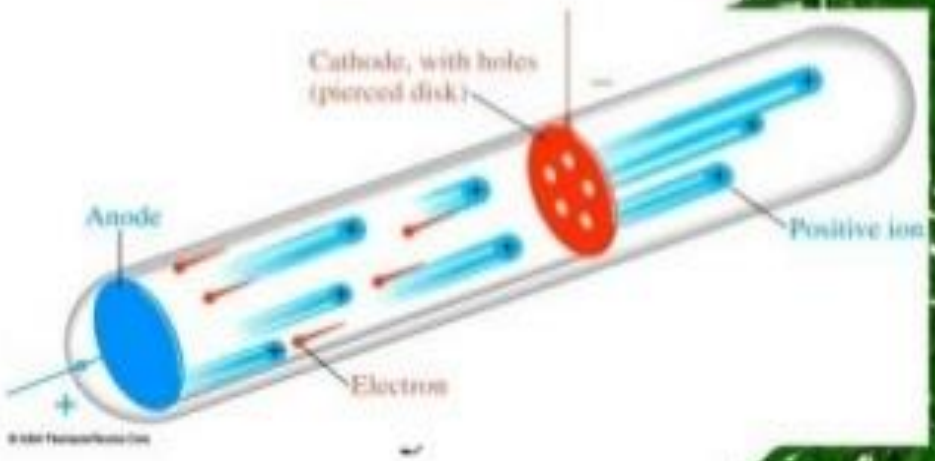
- BY THE END OF THIS PART OF LESSON,STUDENTS WILL BE ABLE TO
- Define canal rays? Who discovered it?
- How canal rays were discovered?
- What are the properties of canal rays?

DISCOVERY OF PROTON



Canal Rays and Protons (1886)

- Eugene Goldstein noted streams of positively charged particles in cathode rays in 1886.
  - Particles move in opposite direction of cathode rays.
  - Called "Canal Rays" because they passed through holes (channels or canals) drilled through the negative electrode.
- Canal rays must be positive.

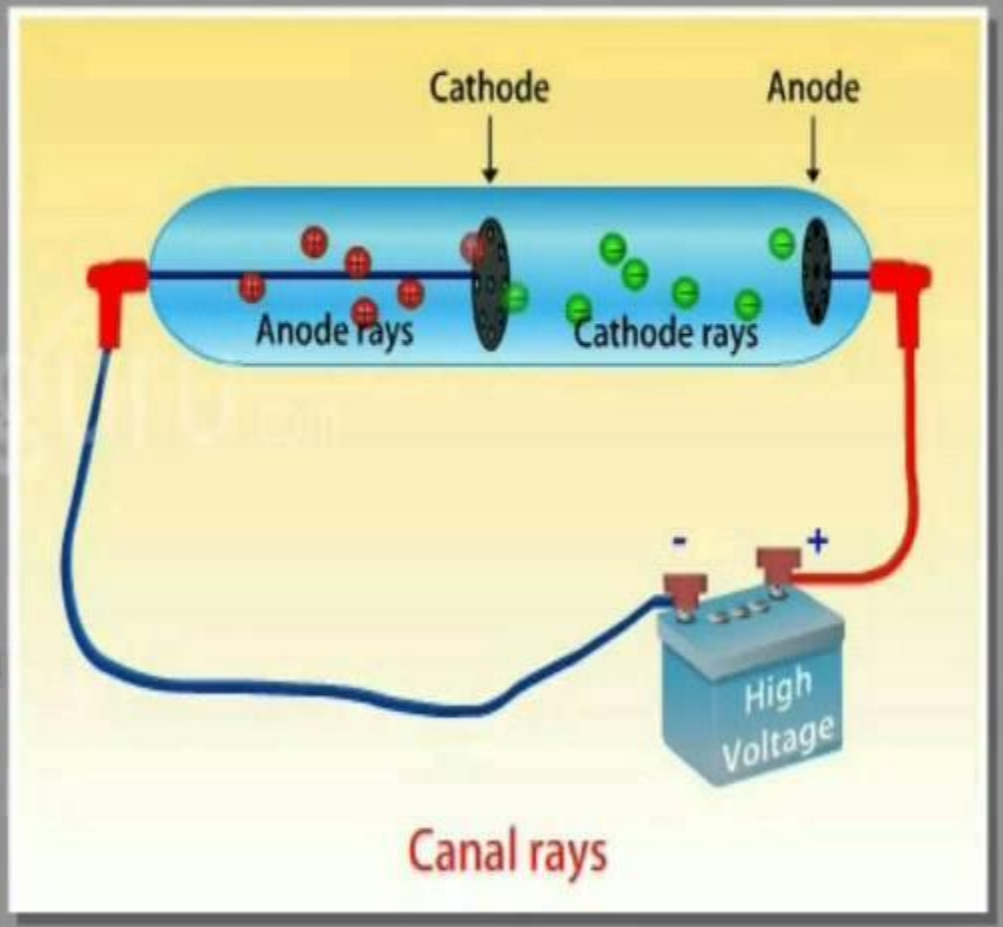


Discovery of Protons and Neutrons

Goldstein, in 1886 used a perforated cathode in a discharge tube. On passing the electric discharge at low pressure he observed a new type of rays carrying a positive charge streaming behind the cathode. These rays were named anode rays or canal rays.

Properties of Anode rays:

The charge to mass ratio of the particles in the anode rays was found to depend upon the nature of the gas in the discharge tube. It was observed that $\frac{e}{m}$ ratio was maximum when hydrogen gas was taken in the discharge tube. This indicated that positive ions formed from hydrogen are lightest. These lightest positively charged particles were named protons.



DISCOVERY:

- **Explain the discovery of positive or canal rays ?**
- **DISCOVERY OF POSITIVE RAYS OR CANAL RAYS :(Discovery of proton by Goldstein in 1886)**
- **Ionization of atoms or molecules in a discharge tube form positive ions. e.g. ionization of Neon gas $Ne - e^- \rightarrow Ne^{+1}$ .These positive ions then moves towards cathode in a discharge tube.**
- **CONSTRUCTION AND WORKING :**
- **A one metre long discharge tube was taken having a perforated cathode.**
- **The electrodes were connected to a high voltage.**
- **Atoms are electrically neutral. They contain equal number of positive and negative particles.**
- **When electric current was passed through the gas at low pressure, then cathode rays are produced from cathode.**
- **These rays ionize the gas in the discharge tube.**
- **They removed electron from the gas molecules and form positive ions.**
- **These ions start moving towards the perforated cathode as positive rays.**
- **$M - e^- \rightarrow M^{+1}$**
- **$He - 2e \rightarrow He^{+2}$**
- **Since these rays pass through the holes (canals) in the cathode ,therefore, these are called canal rays. These rays were also called anode rays (positive rays) since they carry a positive charge.**

PROPERTIES:

- **Write the properties of positive rays? (protons)**
- **They travel in a straight line perpendicular to the anode surface.**
- **They can be deflected in an electric field.**
- **Their deflection is towards cathode showing that they are positively charged.**
- **They produces flashes on ZnS plate.**
- **The e/m ratio depends upon the nature of the gas.**
- **The highest e/m is obtained if hydrogen gas is present in the tube.**
- **Their e/m ratio is smaller than that of an electron .**
- **The positive particle obtained from H_2 gas is the lightest among all the positive particles.**
- **A particle obtained from positive rays is called proton. This name was suggested by Rutherford.**
- **The mass of positive particle is never less than that of a proton.**
- **The mass of proton is 1836 times more than that of an electron.**

POINTS TO PONDER:

- Cathode rays travel in straight line .Explain it.
- Cathode rays are material particles having definite mass and velocity .Explain it.
- How positive rays are produced?
- How mass of electron can be calculated from e/m ratio and charge?
- Why it is necessary to decrease the pressure in the discharge tube to get the cathode rays?
- The e/m value of positive rays for different gases are different but these for cathode rays the e/m value is the same. Why?

Today's Learning

Don't forget to put your name on!

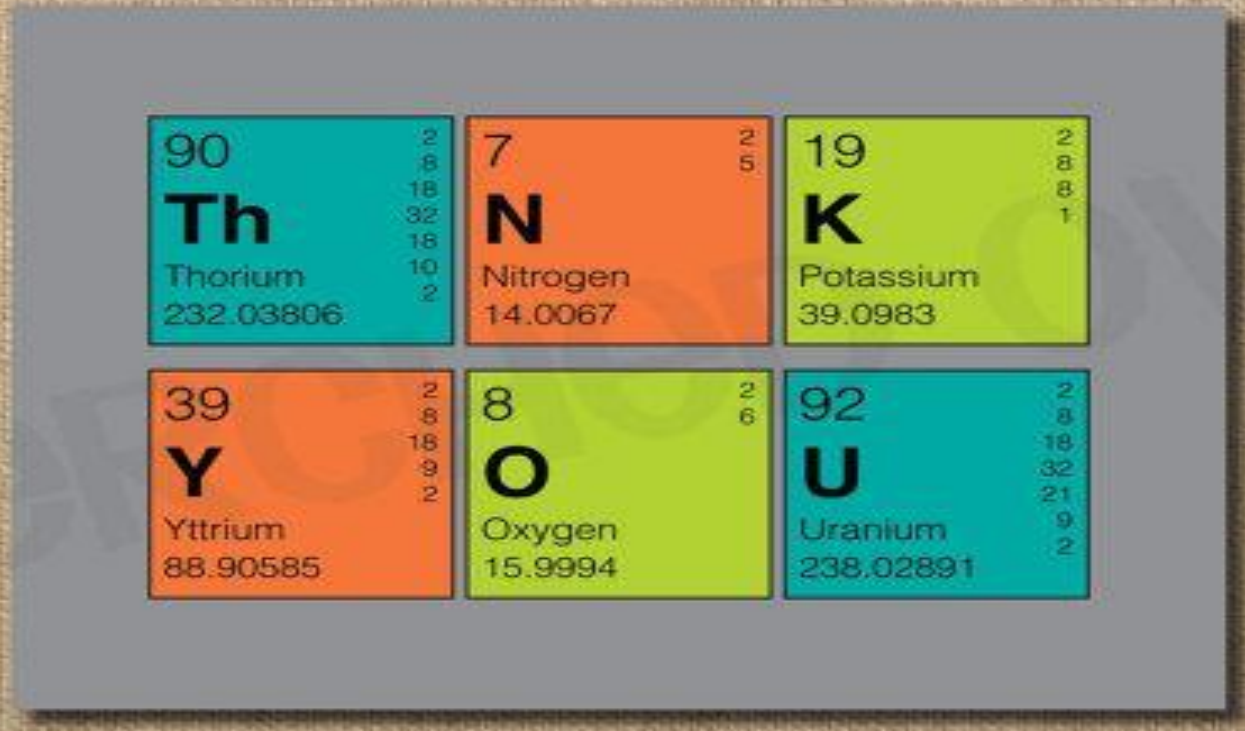
Something I can do now that I couldn't do before the lesson is...	A question I would like to know the answer to is...	I need to improve on...

HOME-WORK:

- NOTE:ATTEMPT ANY ONE QUESTION:
- Write the properties of canal rays?
- How protons(canal rays) were discovered?

LESSON CLOSURE:


good bye
good bye
SCHOOL BUS


90
Th
Thorium
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7
N
Nitrogen
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19
K
Potassium
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Y
Yttrium
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2 8 18 9 2
8
O
Oxygen
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Uranium
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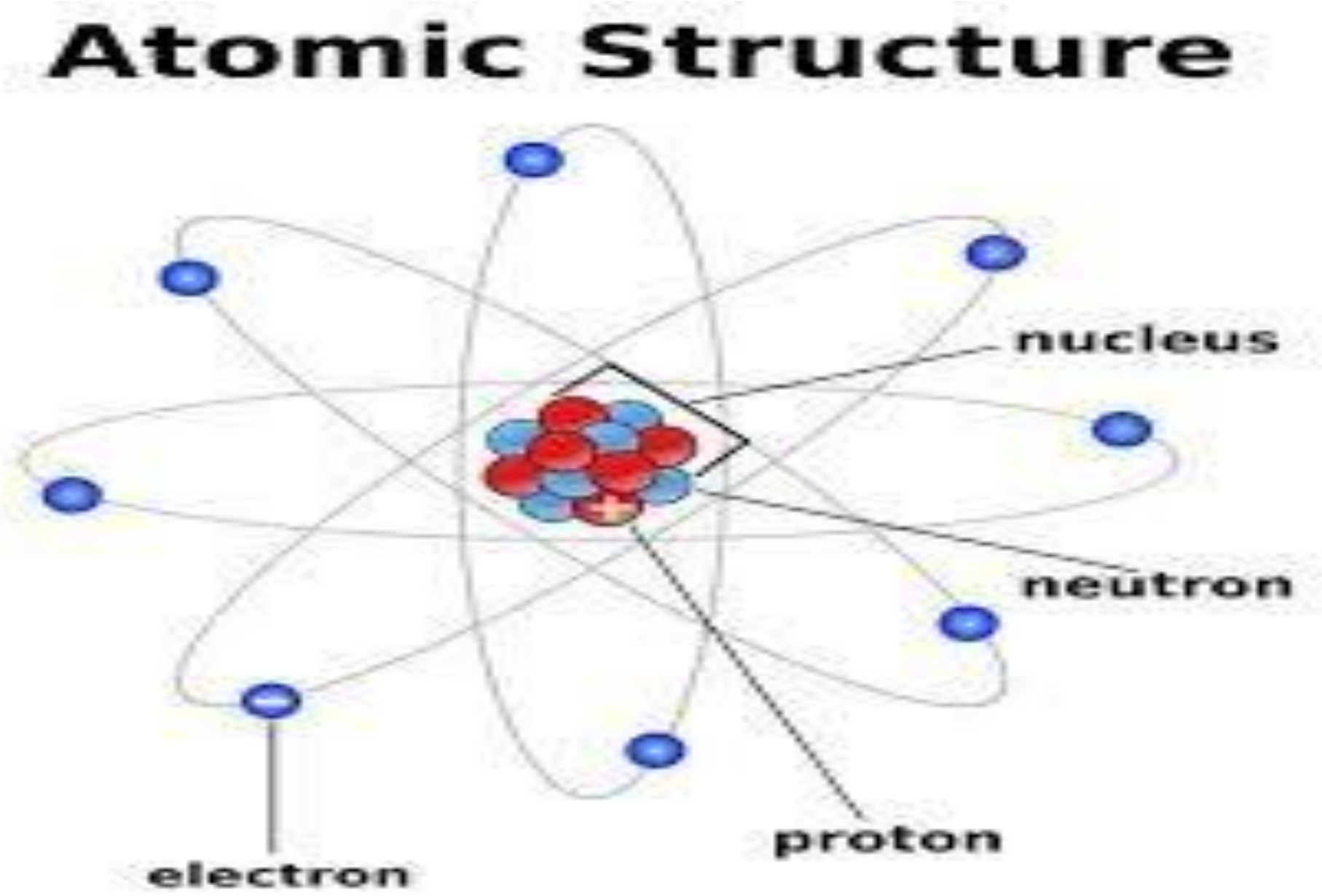
Thank
You

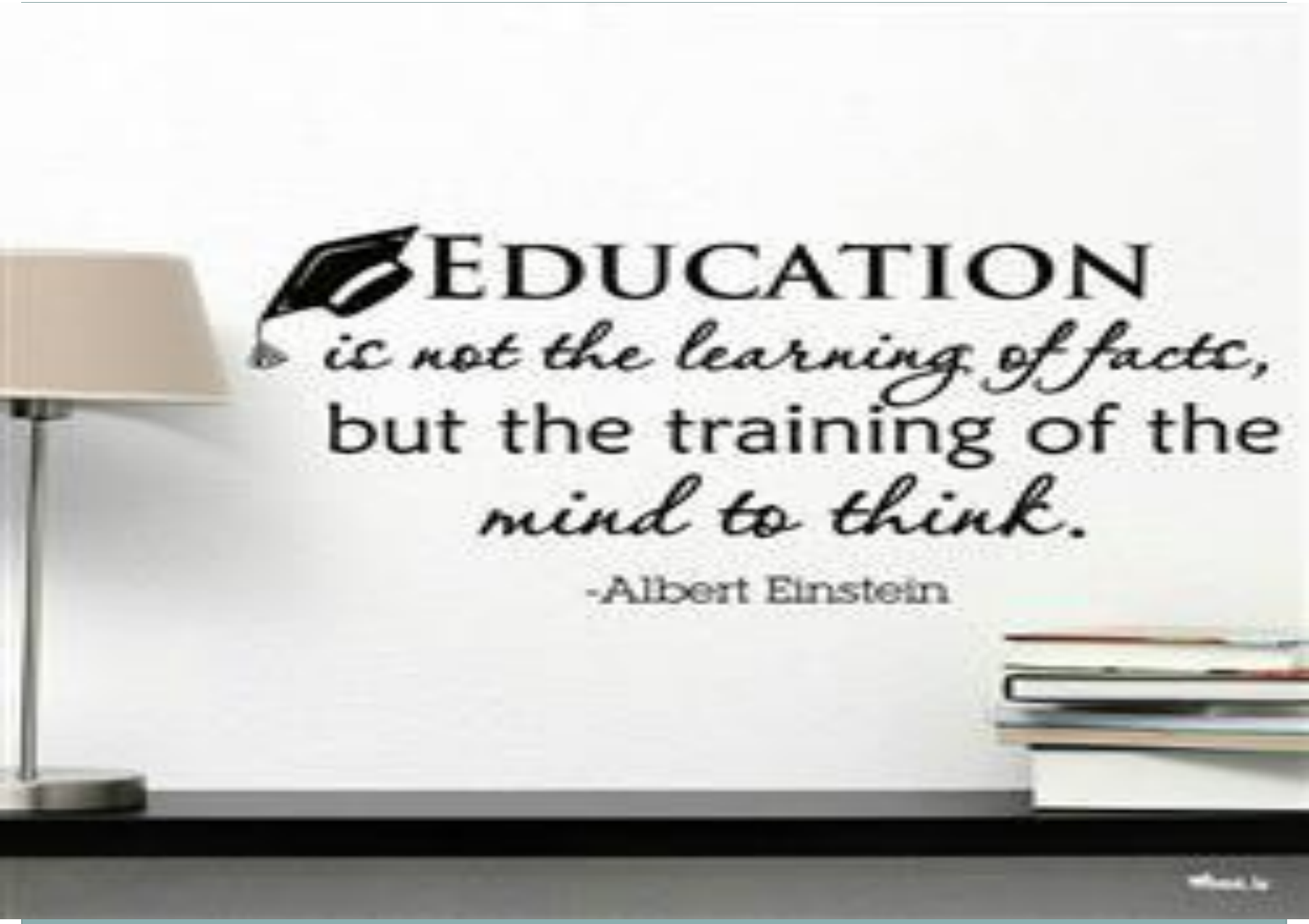

TAKE CARE

LECTURE NO:6



MESSAGE OF THE DAY:

When you wish good for others, good things come back to you. This is the LAW OF NATURE.


EDUCATION
is not the learning of facts,
but the training of the
mind to think.
-Albert Einstein


WELCOME
BACK


HAHA! SO WE MEET AGAIN!!

>> Ready for Anything

WELCOME BACK TO VIRTUAL CLASSES!

#WEAREALWAYSTOGETHER

AMERICAN

A WARM WELCOME TO ALL THE STUDENTS IN THE ONLINE CLASSES.THIS IS D.CHARLES

WE ARE GOING TO START OUR ONLINE CHEMISRTY LESSON TODAY.I HOPE YOU ALL WILL ENJOY AND LEARN.

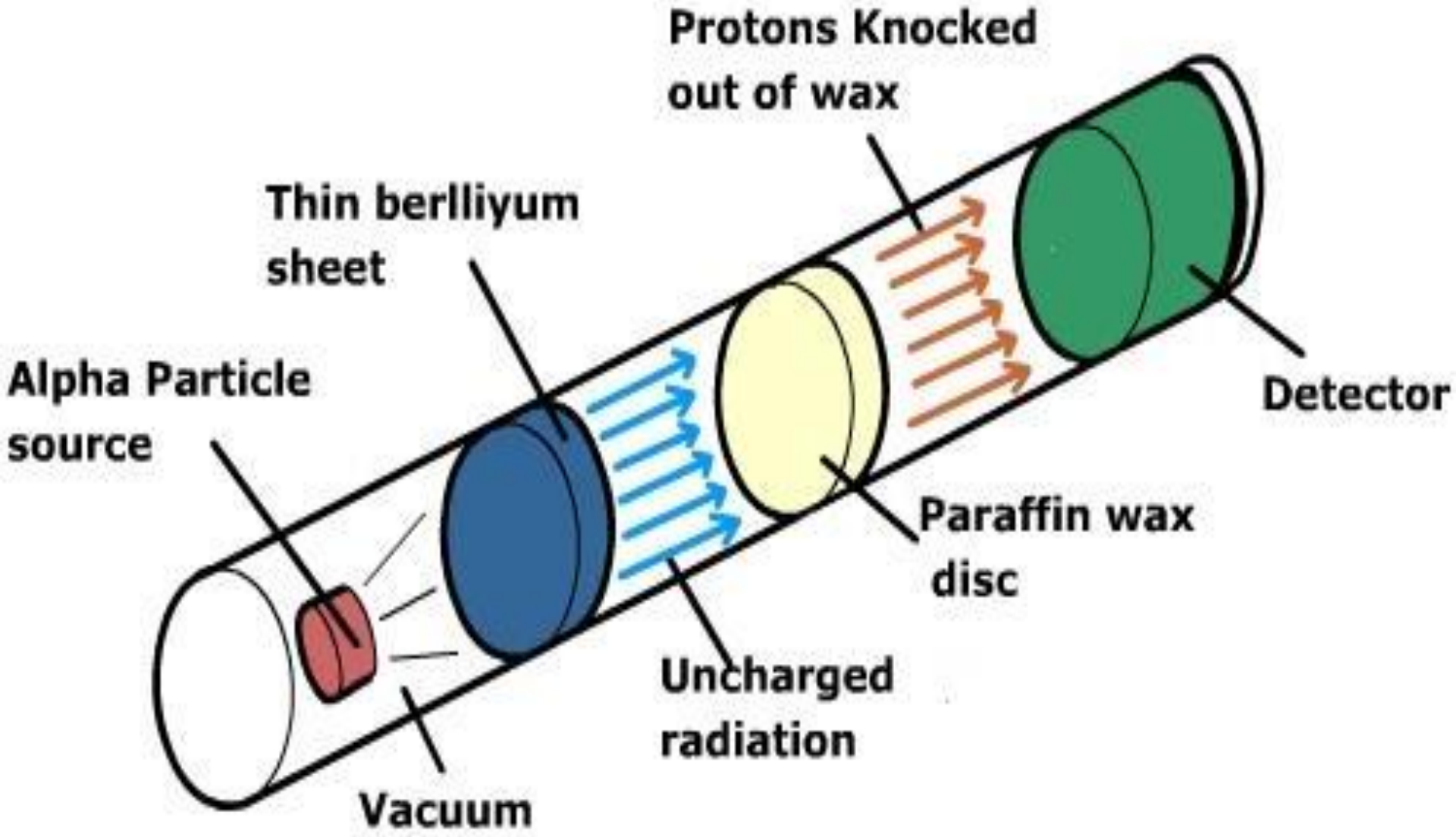
.

RULES OF THE CLASS:

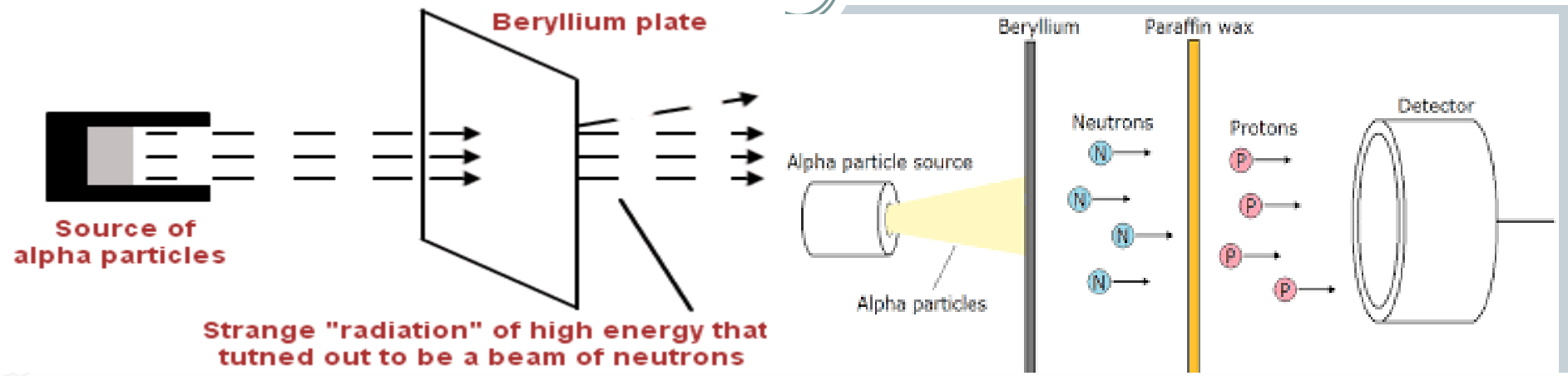
1)BE ON TIME FOR ALL YOUR CLASSES.
2)RESPECT ALL PARTICIPANTS OF THE CLASS.
3)DO NOT CREATE ANY DISTURBANCE.
4)RAISE HAND IF YOU HAVE A QUESTION.
5)PAY ATTENTION TO YOUR TEACHER.

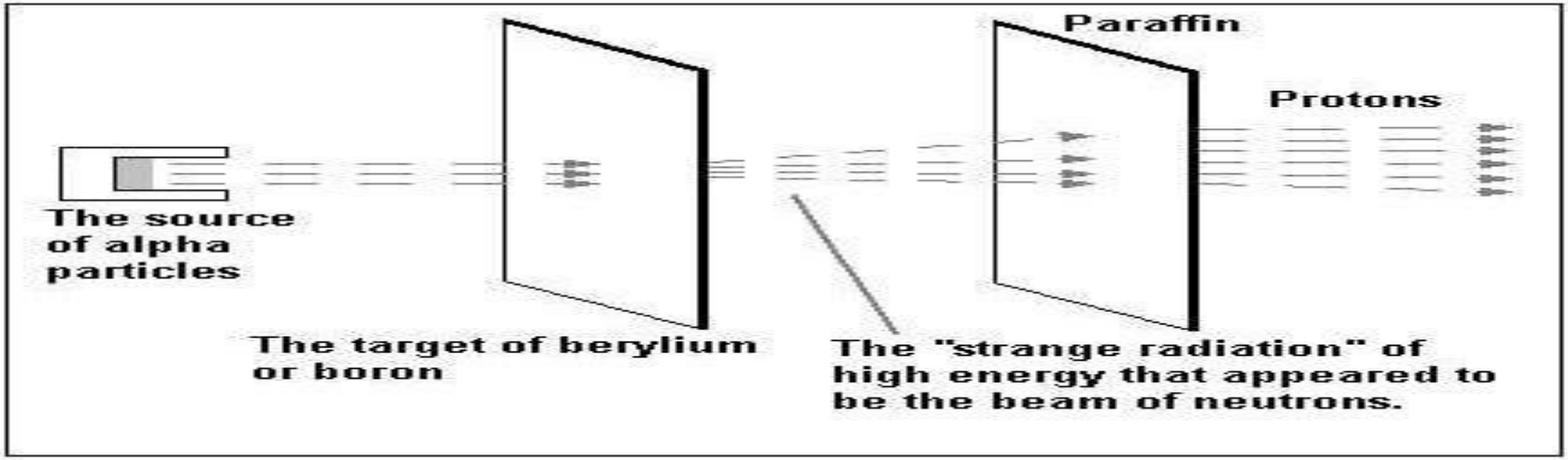
Chadwick (the discoverer of the neutron) was a student of Rutherford (discoverer of the proton) who was the student of Thomson (the discoverer of the electron).

POINTS TO PONDER:



POINTS TO PONDER :



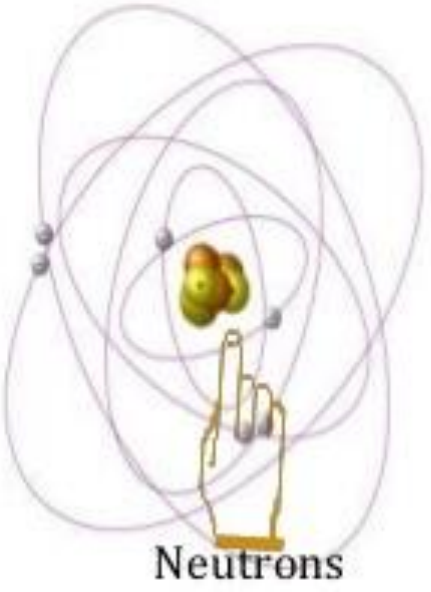


LESSON OBJECTIVES:6

- BY THE END OF THIS PART OF LESSON,STUDENTS WILL BE ABLE TO
- Define neutron? Who discovered neutron?
- How neutron were discovered ?
- Differentiate between types of neutron?
- Importance of neutron in our daily life?

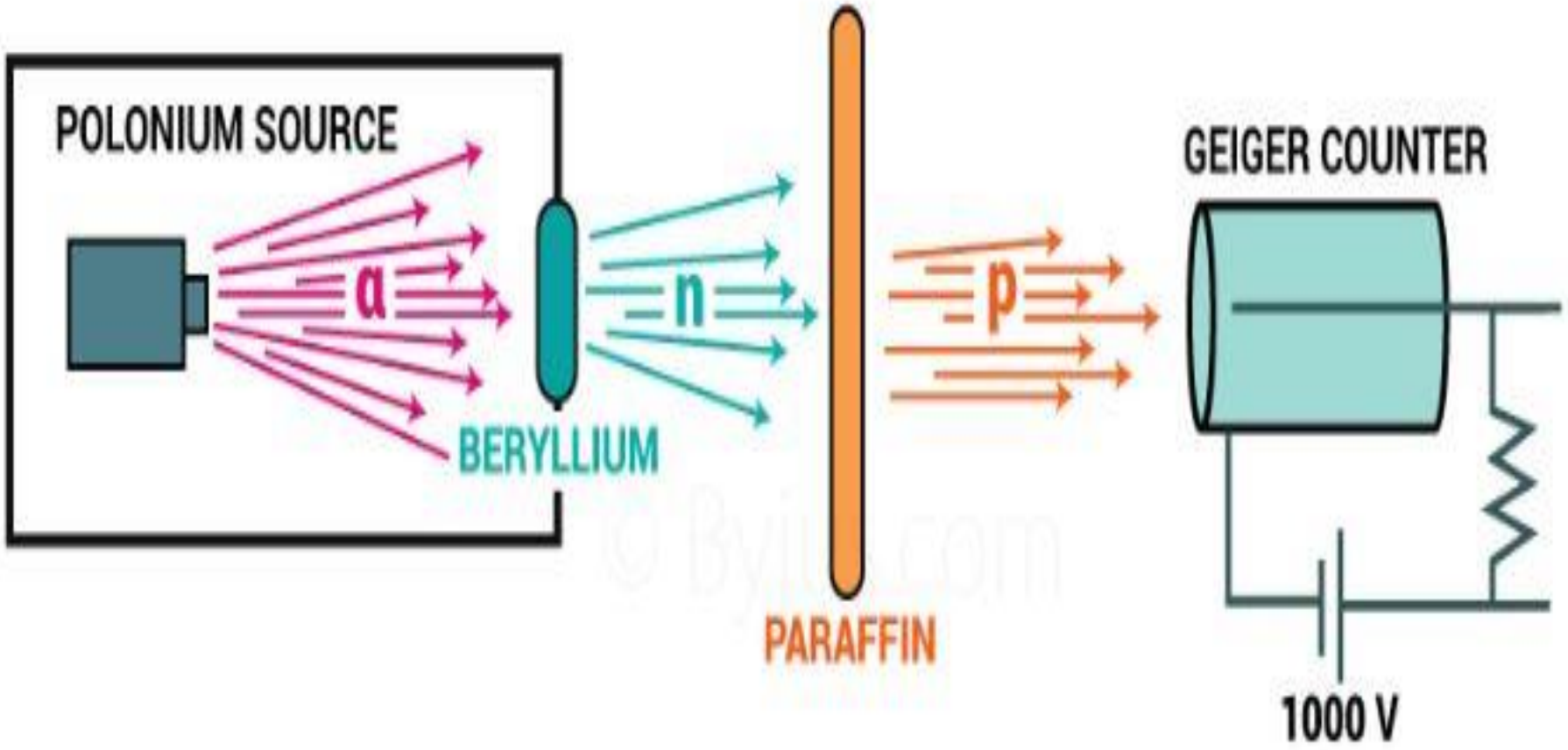
DISCOVERY OF NEUTRONS

Chadwick smashed alpha particles into beryllium, a rare metallic element, and allowed the radiation that was released to hit another target: paraffin wax. The experiment results showed a collision with beryllium atoms would release massive neutral particles, which Chadwick named neutrons.



Science

DISCOVERY OF NEUTRON



3.1.3: Chadwick's Discovery of the Neutron:

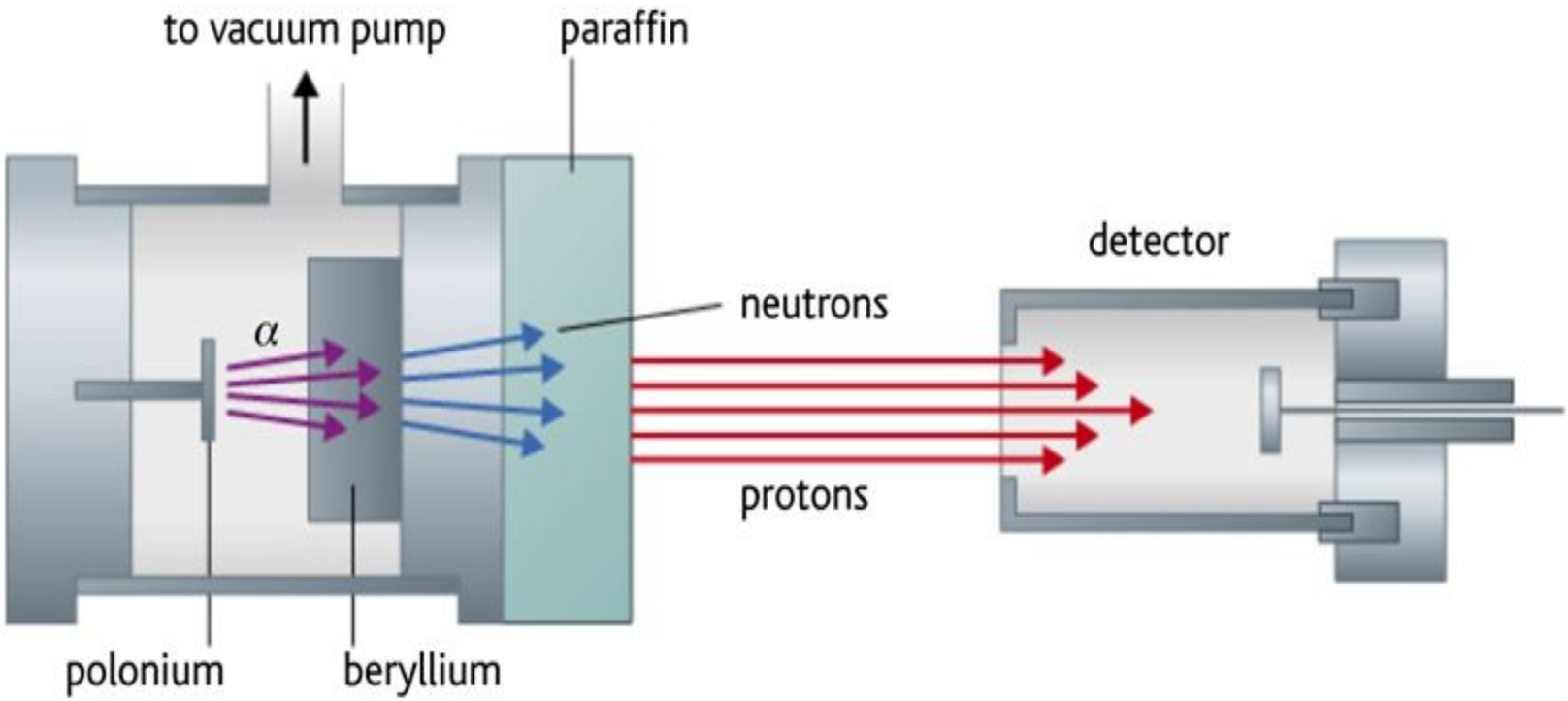
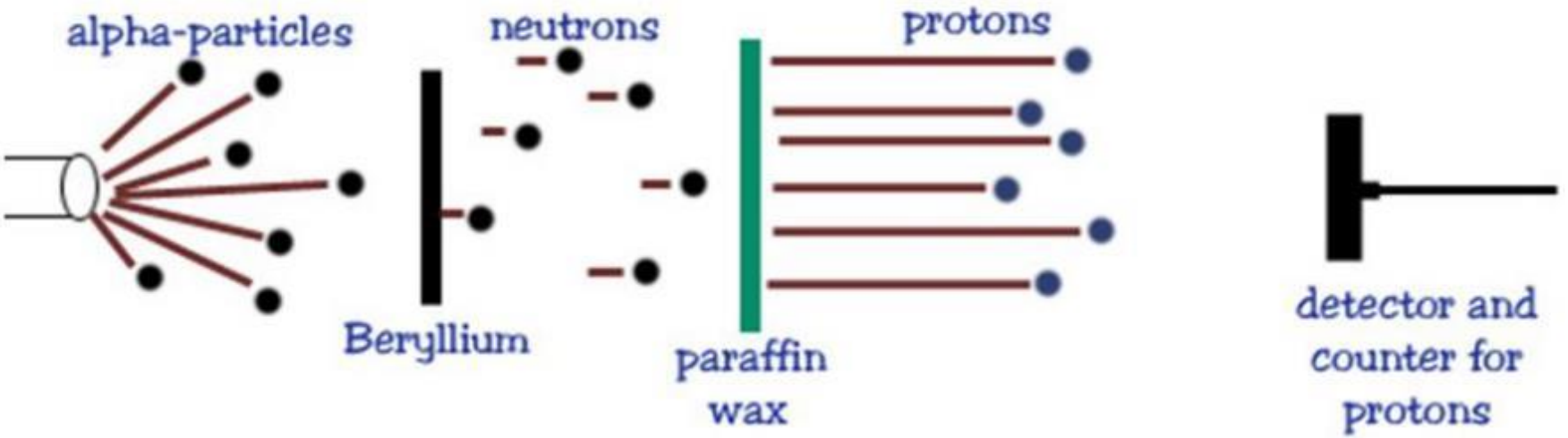
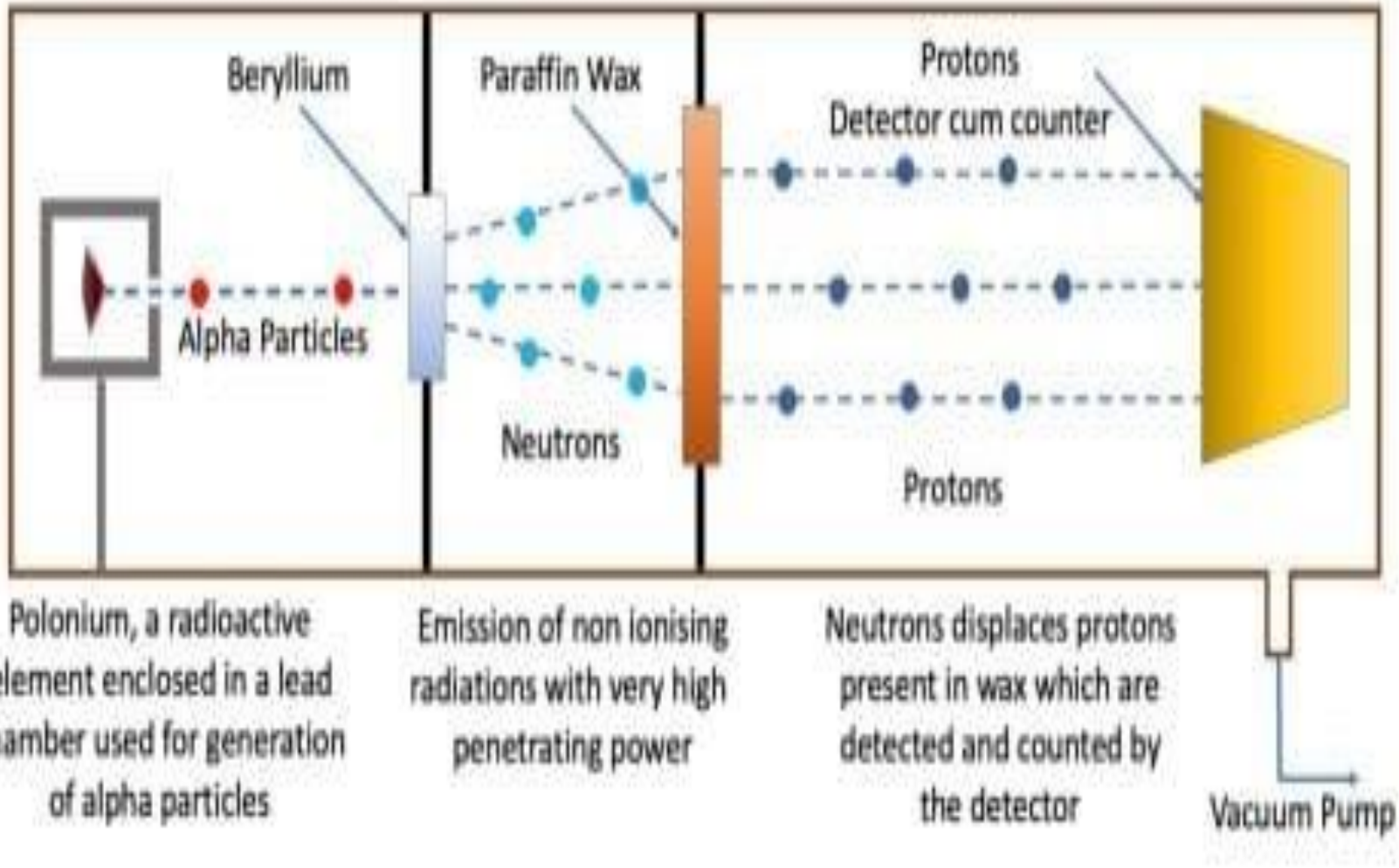


fig. 3.1.4 Chadwick's experiment to determine the existence of the neutron relied on conservation of momentum to work out the mass of this neutral particle.

James Chadwick and Neutron Experiment (1932)

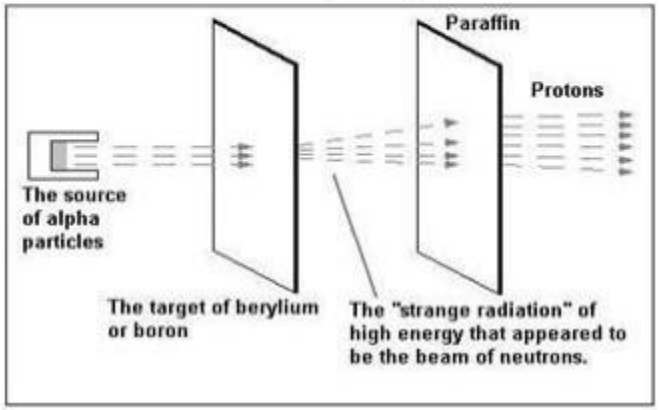


JAMES CHADWICK EXPERMINTAL SETUP



THE DISCOVERY OF THE NEUTRON

- James Chadwick discovered the neutron in 1932
- He performed experiments with the goal of looking for a neutral particle- one with the same mass as a proton, but with zero charge
- He used scattering data to calculate the mass of a neutral particle
- He bombarded beryllium atoms with alpha particles which produced an unknown radiation



- Chadwick interpreted this radiation as being composed of particles with a neutral electrical charge and the approximate mass of a proton
- This particle became known as the **NEUTRON!!!**
- He was able to determine that the neutron **DID** exist and that its mass was about 0.1 percent more than the proton's

Electron, proton spin = ½ħ (measured)

Nitrogen nucleus ($A = 14, Z = 7$): 14 protons + 7 electrons = 21 spin ½ particles

TOTAL SPIN MUST HAVE HALF-INTEGER VALUE

Measured spin = 1

DISCOVERY OF THE NEUTRON (Chadwick, 1932)

James Chadwick

Neutron: a particle with mass ≈ proton mass but with zero electric charge

Solution to the nuclear structure problem:

Nucleus with atomic number *Z* and mass number *A*: a bound system of *Z* protons and (*A* – *Z*) neutrons

Nitrogen anomaly: no problem if neutron spin = ½ħ

Nitrogen nucleus (A = 14, Z = 7): 7 protons, 7 neutrons = 14 spin ½ particles

⇒ **total spin has integer value**

Neutron source in Chadwick's experiments: a ^{210}Po radioactive source (5 MeV α – particles) mixed with Beryllium powder ⇒ emission of electrically neutral radiation capable of traversing several centimetres of Pb:

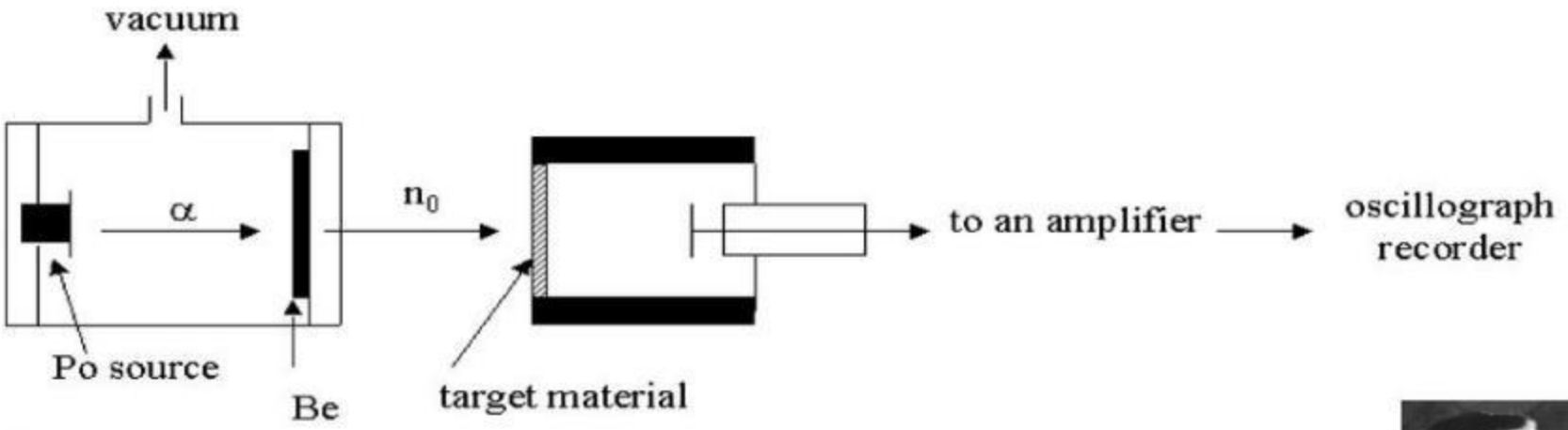
$$^{4}He_{2} + {}^{9}Be_{4} \rightarrow {}^{12}C_{6} + \text{neutron}$$

↑

α - particle

Discovery of the neutron: Chadwick's experiment

Chadwick used ionisation chamber in which he could measure ionisation produced by a charged particle and the length of the track. He also used alpha particles from polonium source and beryllium as a target for alpha particles.
He put several additional target materials (hydrogen, helium, lithium, beryllium, carbon, air and argon) on the way of neutral radiation from beryllium. Particles ejected from hydrogen behaved like protons.



These particles were neutral particles with the mass equal to that of proton. Chadwick called it the neutron in a letter to Nature in February 17, 1932. 1935 - Chadwick received the Nobel Prize.

Discovery of the Neutron

- Chadwick's set-up an experiment discovering neutrons
- -alpha particles are projected towards a beryllium target
- -the emitted particles fell on an object called paraffin wax
- -once it fell on the paraffin wax, it released another type of particles
- -that other type of particles were protons
- -what went through the beryllium target were uncharged and had a similar mass to protons…called NEUTRONS

Discovery of neutron (III)

Chadwick's neutron chamber containing parallel disks of radioactive polonium and beryllium. Radiation is emitted from an aluminium window at the chamber's end

Chadwick reported the Joliot-Curie's experiment to Rutherford, who did not believe that gamma rays could account for the protons from the wax. He and Chadwick were convinced that the beryllium was emitting neutrons. Neutrons have nearly the same mass as protons, so should knock protons from a wax block fairly easily.

"The lions den" of the Cavendish: Rutherford, foreground, with colleagues; Chadwick is at right.

Chadwick's Experiment - 1932

- Found that alpha particles shot at beryllium made a beam form
- The beam had the same mass of a proton but was electrically neutral

**DISCOVERED THE NEUTRON!!

What is a neutron?

- The neutron is a subatomic particle with no net electric charge.

Nucleus

- Neutrons are *usually* bound (via strong nuclear force) in atomic nuclei. Nuclei consist of protons and neutrons—both known as nucleons.
- The number of protons determines the element & the number of neutrons determines the isotope, e.g. ^{15}N and ^{14}N have 7p and 8n and 7n respectively.

POINTS TO PONDER:

The Neutron

- The discovery of the neutron in 1932 was the single most important discovery in nuclear physics after the discovery of the nucleus itself.
- Until the neutron was discovered, physicists could not understand nuclei.
- The discovery of the neutron made it possible to understand for the first time how *A* could be greater than *Z*.
- Neutrons are not repelled by the positive charge of a nucleus and therefore can approach a nucleus without having to overcome an energy barrier.
- The nuclear force between neutrons and protons, and between neutrons and nuclei, is generally attractive. hence if a neutron gets close enough, it will be attracted by and become bound to a nucleus.
- Neutron bombardment quickly became a tool for probing the structure of nuclei and the properties of the nuclear force

Properties of neutrons

- neutrons are fundamental particles
  - only found in the nucleus
  - same size and mass as a proton
- neutrons have no electric charge
  - have no chemical properties
  - are extremely penetrating though atoms
- neutrons interact only with nuclei of atoms
  - collide and transfer energy like gas molecules
  - describe by energy E (meV) = $5.19\ v^2$ where v (kms^{-1}) is velocity

Properties of Neutron

1. Free neutron decays into proton ($_{+}^{1}P$)with emission of an electron ($_{1}^{0}e$)and a neutrino ($_{0}^{0}n$).

$$_{0}^{1}n + _{+1}^{1}P \rightarrow _{-1}^{0}e + _{0}^{0}n$$

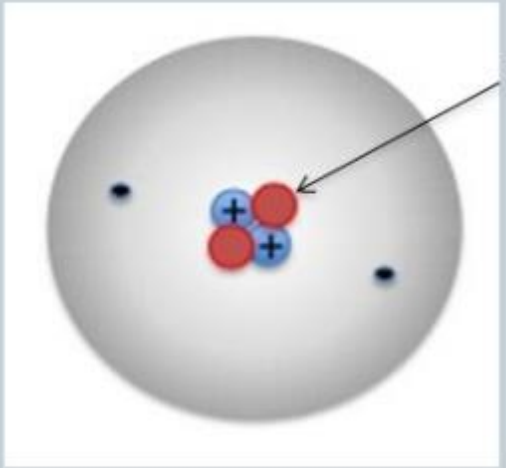
2. Neutrons cannot ionize gases.
3. Neutrons are highly penetrating particles.
4. They can expel high speed protons from paraffin, water, paper and cellulose.
5. When neutrons travel with an energy 1.2 Mev, they are called fast neutrons but with energy below 1ev are called slow neutrons. Slow neutrons are usually more effective than fast ones for fission purposes.
6. When neutrons are used as projectiles, they can carry out nuclear reactions. A fast neutron ejects an α-particle from nucleus of nitrogen atom and boron is produced,

PREDICTION/DISCOVERY OF NEUTRON:

- **Explain the discovery of neutrons?**
- **DISCOVERY OF NEUTRONS RUTHERFORD PREDICTION: In 1920, Rutherford predicted the presence of neutral particle (neutron) in the nucleus of an atom .It is because the atomic masses of atoms could not be explained on the basis of protons and electrons only. For e.g. Aluminium (Al) has atomic mass 27a.m.u and atomic number 13.So the difference of mass of the element could not be explained.**
- **JAMES CHADWICK WORK: In 1932 James Chadwick discovered neutron in the nucleus of an atom. He was awarded noble prize in physics in 1935 for this discovery.**
- **EXPERIMENT BY JAMES CHADWICK : A stream of alpha particles produced from Polonium (Po) was directed at target metal foil (Be)**
- **It was noticed that some penetrating radiations were produced. These radiations were called neutrons, because the charge detector showed them to be neutral.**
- **FORMATION OF ɑ-PARICLES FROM POLONIUM**
- **$_{84}Po^{216} \rightarrow {}_{82}Pb^{212} + {}_{2}He^{4}$ (ɑ-Particles)**
- **FORMATION OF NEUTRON :**
- **$_{2}He^{4} + {}_{4}Be^{9} \rightarrow {}_{6}C^{12} + {}_{0}n^{1}$ (neutron)**

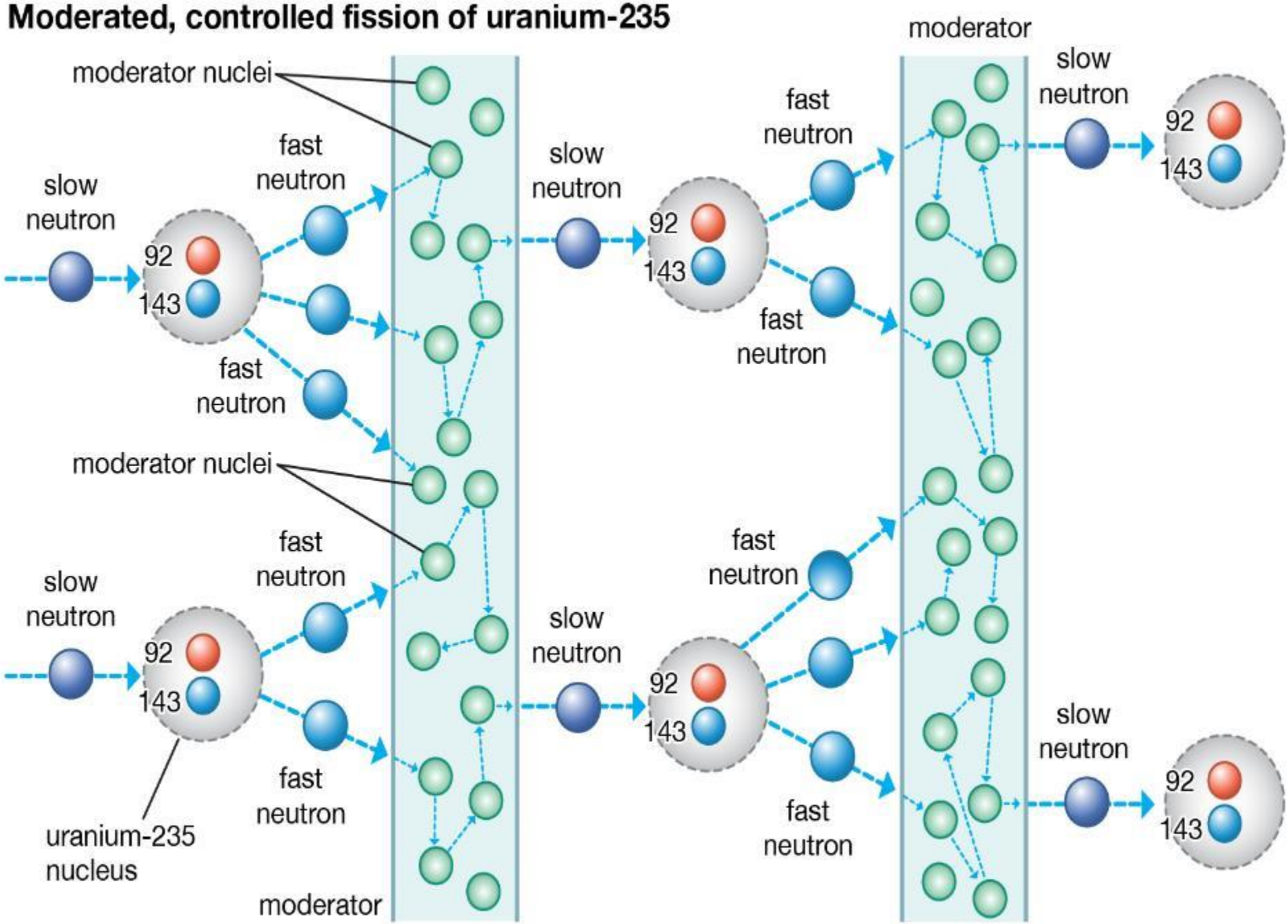
What are the properties of neutrons?

- Neutrons are located in the nucleus of an atom.
- Neutrons have no electrical charge, they are neutral.
- Neutrons have a mass of 1 amu (they are the same size as protons).



PROPERTIES OF NEUTRONS:

- **PROPERTIES OF NEUTRONS: Neutrons have the following properties .**
- **Free neutron decay into proton with the emission of electron and neutrino. $_0n^1 \rightarrow {}_{+1}P^1 + {}_{-1}e^1 + {}_0n^0$ (neutrino is a particle of small mass).**
- **They cannot ionizes gases.**
- **They are highly penetrating particles.**
- **When neutrons travel with energy of 1.2 Mev or more, they are called Fast Neutrons. When they have energy below1 e.v. they are called slow neutrons.**
- **They are not deflected in electric and magnetic fields. Hence they are neutral in nature.**
- **They can knockout high speed protons from paraffins, water, paper and cellulose.**
- **Slow neutrons are more effective than the fast ones for the fission purposes.**
- **When neutrons are used as projectiles, they can carry out the nuclear reactions. For e.g. A neutron can eject an alpha particle from the nucleus of nitrogen and boron is produced.**
- **$_0n^1 + {}_7N^{14}$ ----→ $_5B^{11} + {}_2He^4$**
- **When the slow moving neutrons hit the Cu metal, beta radiations are emitted.**
- **$_0n^1 + {}_{29}Cu^{66}$--------→$_{30}Zn^{66} + {}_{-1}e^0$ (beta –rays)**
- **1 a.m.u (atomic mass unit) =$1.6x10^{-27}$kg =$1.6x10^{-24}$kg.**



Difference between thermal neutron and fast neutron

Thermal Neutron	Fast Neutron
1. A free neutron that has energy in the order of 0.025 eV is called thermal neutron.	1. A free neutron that has energy in the order of 1 - 20 MeV is called fast neutron.
2. Velocity of thermal neutron is close to 2.2 km/s.	2. Fast neutron has very high velocity, typically in the order of 2×10^4 km/s.
3. A thermal neutron remains in thermal equilibrium with the ambient molecules at Normal Temperature and Pressure (NTP).	3. Fast neutron does not exist in thermal equilibrium with the ambient molecules at Normal Temperature and Pressure (NTP).
4. All such nuclear reactors that work primarily based on the thermal neutrons are called Thermal Reactors.	4. All such nuclear reactors that work primarily based on the fast neutrons are called Fast Reactors.
5. Thermal neutron offers high fission cross-section (~ 583 barns) towards Uranium-235.	5. Fast neutron offers very low fission cross-section (about 1 barn) towards Uranium-235.
6. Prompt neutrons produced in nuclear fission is usually fast neutrons. Thus moderator is required in thermal reactors to slow down the prompt neutrons.	6. No such moderator is required in fast reactors as such reactors work based on fast neutrons.

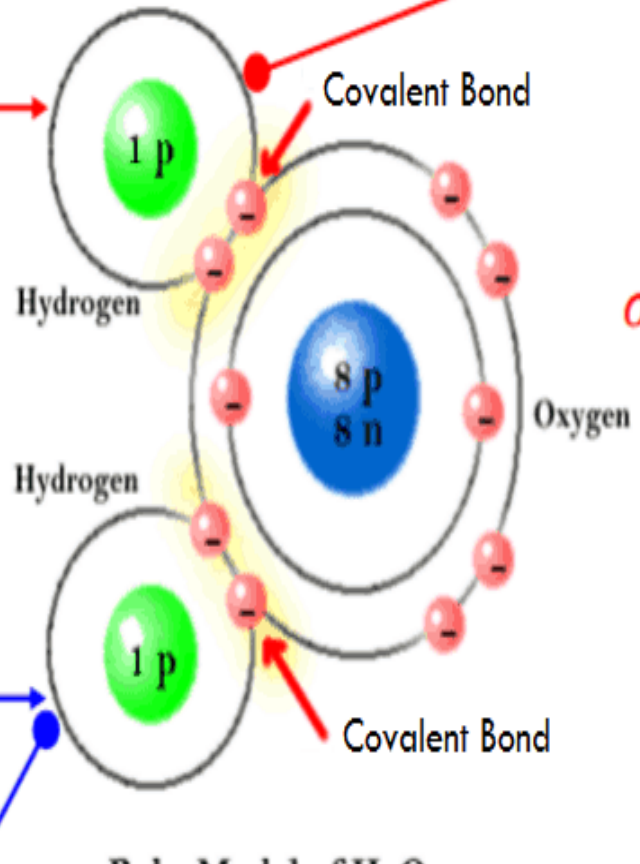
Feels only H

$\tau_{coll} \sim 0$

$E_k \gg E_{chem}$

$\sigma_s(H_2O) = 2\sigma_s(H) + \sigma_s(O)$

Fast neutron



Bohr Model of H_2O

Slow (thermal) neutron

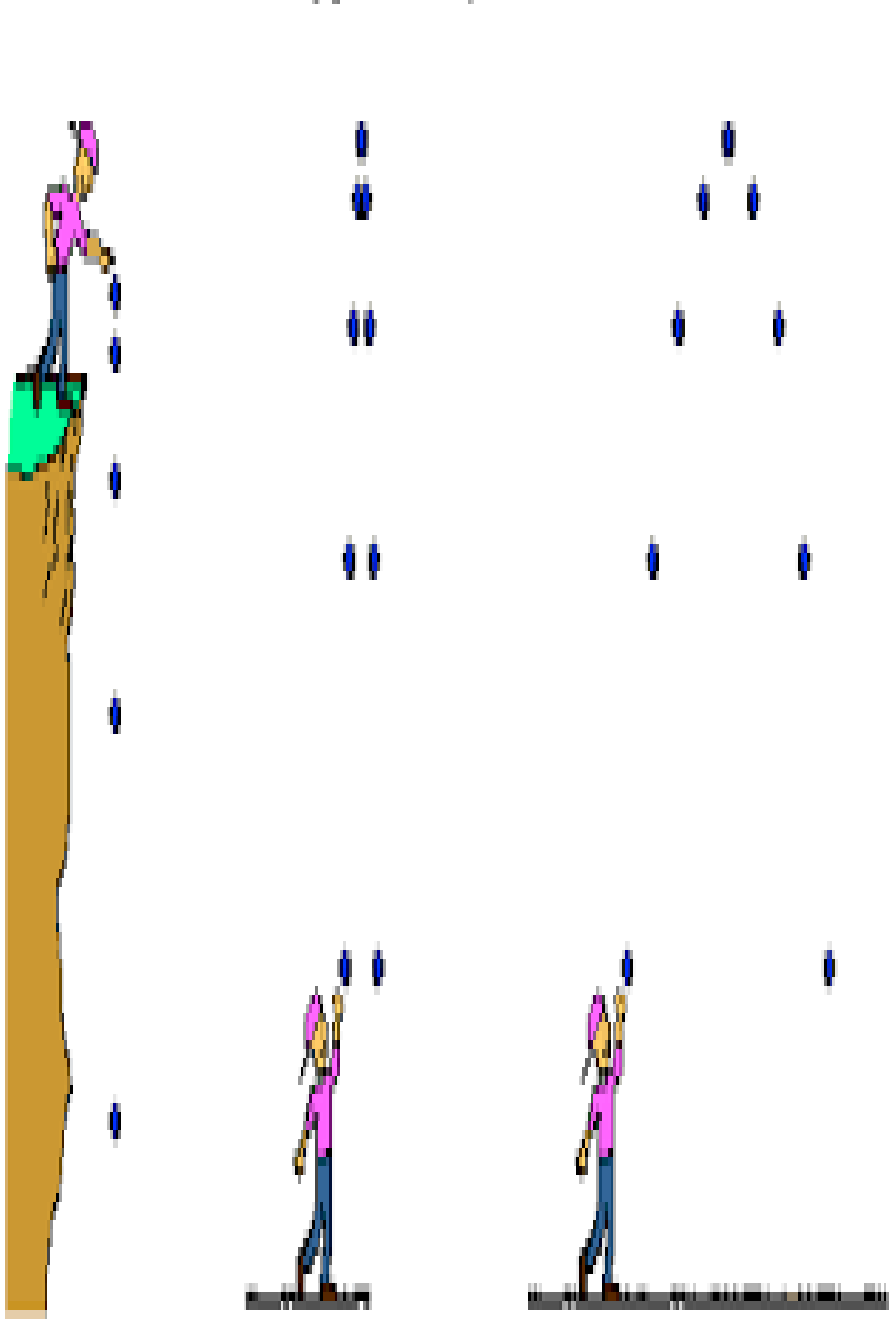
Feels whole molecule

$\tau_{coll} \neq 0$

$E_k \sim E_{chem}$

What is a projectile?

- When a body is in free motion, (moving through the air without any forces apart from gravity and air resistance), it is called a projectile
- Normally air resistance is ignored so the only force acting on the object is the force due to gravity
- This is a uniform force acting downwards



POINTS TO PONDER:

BIOLOGICAL APPLICATIONS OF SEM

- **Virology** - for investigations of virus structure
- **Cryo-electron microscopy** – Images can be made of the surface of frozen materials.
- **3D tissue imaging -**
  - Helps to know how cells are organized in a 3D network
  - Their organization determines how cells can interact.
- **Forensics -** SEM reveals the presence of materials on evidences that is otherwise undetectable
- SEM renders detailed 3-D images
  - extremely small microorganisms
  - anatomical pictures of insect, worm, spore, or other organic structures

Real World Application - PROTON

- The electron transport chain, which occurs in the membrane of mitochondria, uses a proton gradient to help produce ATP, a compound our body uses for energy.
- Most acidic substances have more free protons (hydrogen ions) in them than hydroxide ions. Vinegar, lemon juice, and hydrochloric acid (HCl) are examples of acidic liquids.
- pH is a measure of the number of free protons (hydrogen ions) in a solution. The pH scale ranges from 0-14, with 0 being acidic (more protons) and 14 being basic (fewer protons). pH measurements are widely used to determine the acidity of rain, bodies of water, and liquid waste from factories.
- Proton therapy is also a new treatment for treat cancer. A beam of protons is directed towards a tumor and damages the tumor cells' DNA so they cannot reproduce.

Application of Neutron diffraction

- Used for determination of structure
- Locating Light atoms
- Heavy atoms that absorb x-ray strongly
- Similar atomic no /Isotopes
- Magnetic properties
- Single crystal studies analysis
- Inelastic scattering Used for study of atomic vibration and other excitations

POINTS TO PONDER:

- Why the e/m value of the cathode rays is just equal to that of electron?
- What particles are formed by the decay of free neutrons?
- How the slow moving neutrons prove to be more effective than fast neutron?
- How the air was ionised in millikan's oil-drop experiment?
- The e/m value of hydrogen gas positive rays is 1836 times smaller than that of cathode rays .why?

Today's Learning

Don't forget to put your name on!

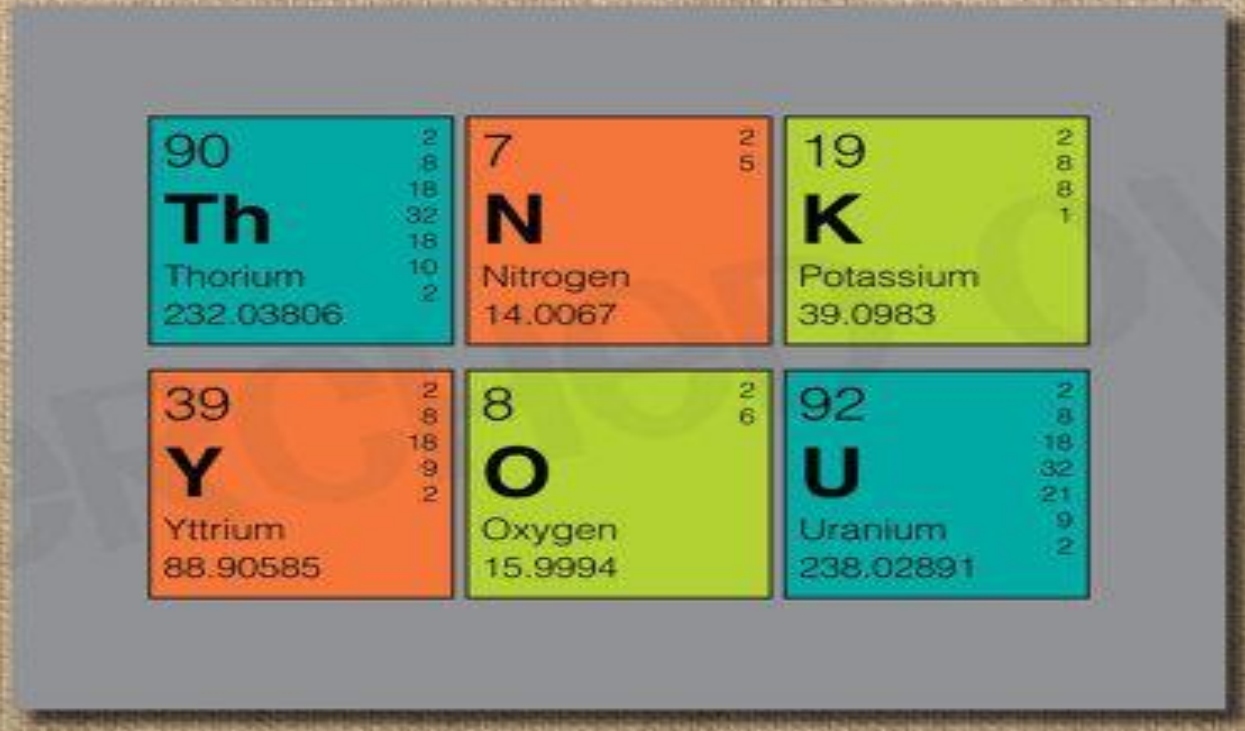
Something I can do now that I couldn't do before the lesson is...	A question I would like to know the answer to is...	I need to improve on...

HOME-WORK:

- NOTE:ATTEMPT ANY ONE QUESTION:
- Write the properties of neutron?
- How neutron were discovered?

LESSON CLOSURE:


good bye
good bye
SCHOOL BUS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Yttrium
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O
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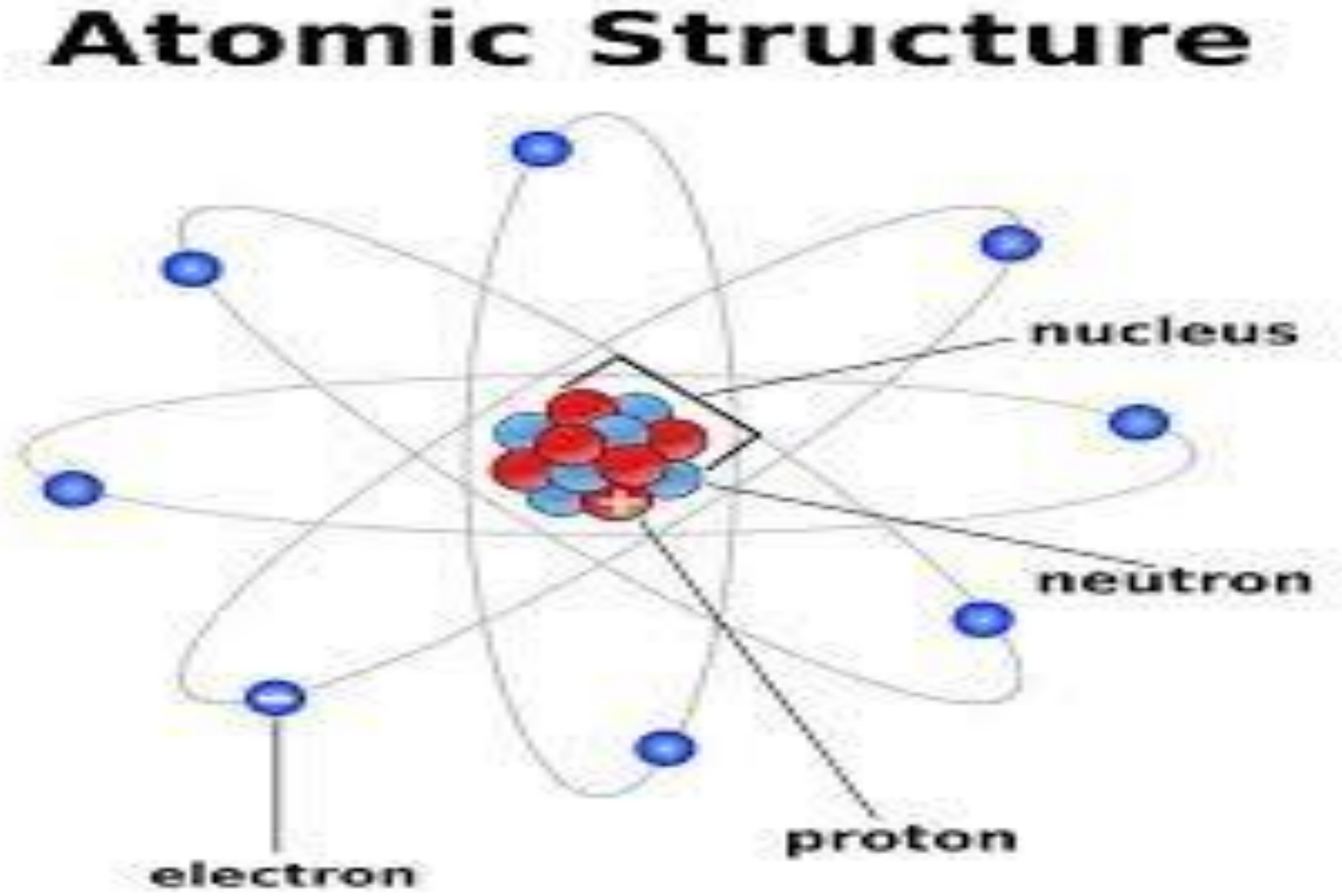
Thank
You


TAKE CARE

LECTURE NO:7



MESSAGE OF THE DAY:

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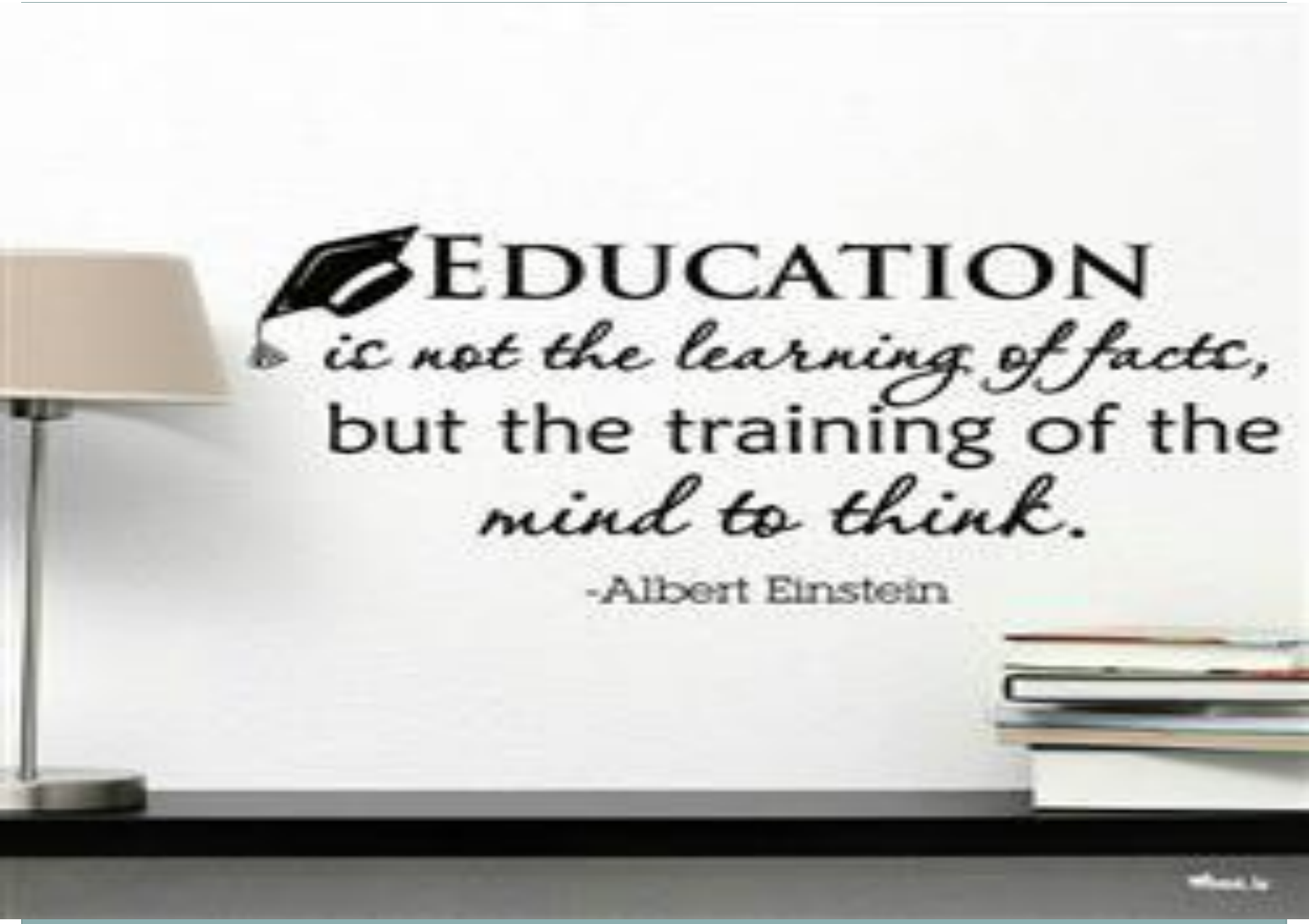
EDUCATION
is not the learning of facts,
but the training of the
mind to think.
-Albert Einstein


WELCOME
BACK


HAHA! SO WE MEET AGAIN!!

>> Ready for Anything

WELCOME BACK TO VIRTUAL CLASSES!

#WEAREALWAYSTOGETHER

AMERICAN

A WARM WELCOME TO ALL THE STUDENTS IN THE ONLINE CLASSES.THIS IS D.CHARLES

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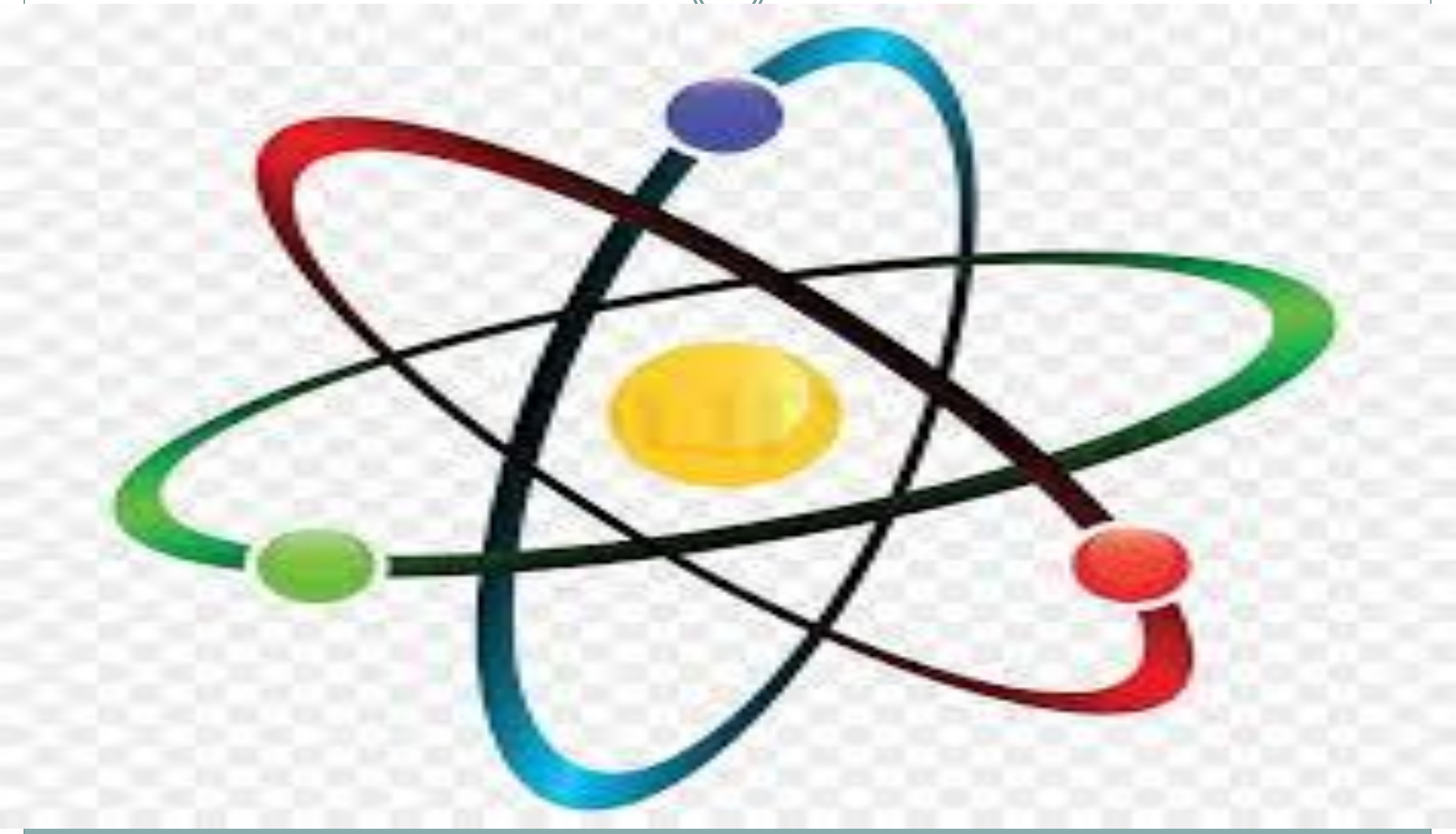
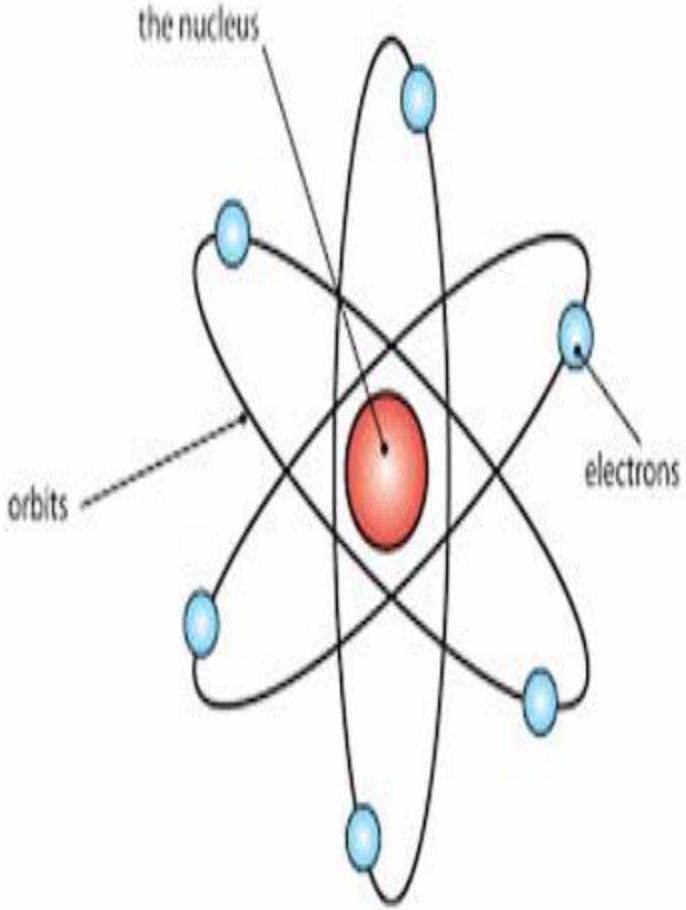
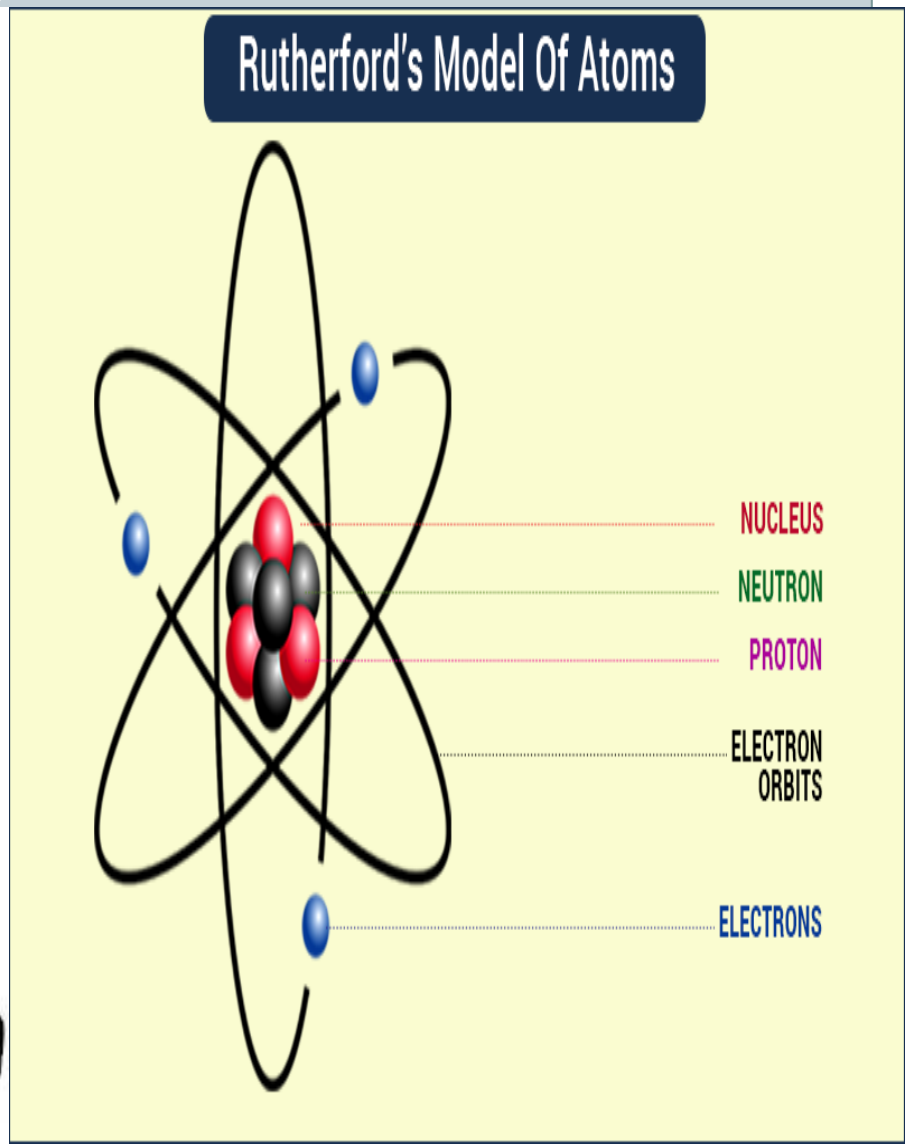
POINTS TO PONDER:



RUTHERFORD'S ATOMIC MODEL:



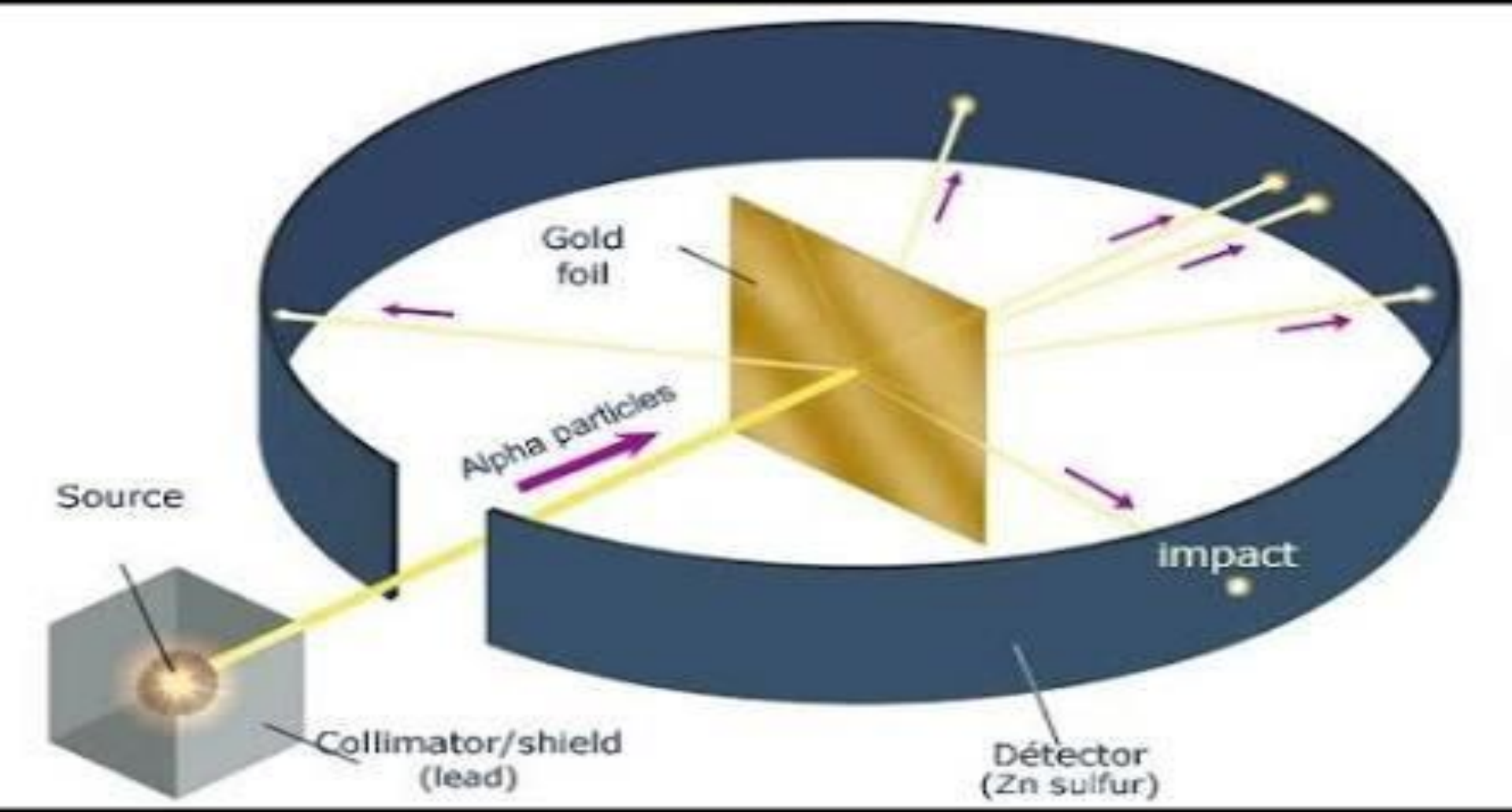
Rutherford's Model Of An Atom



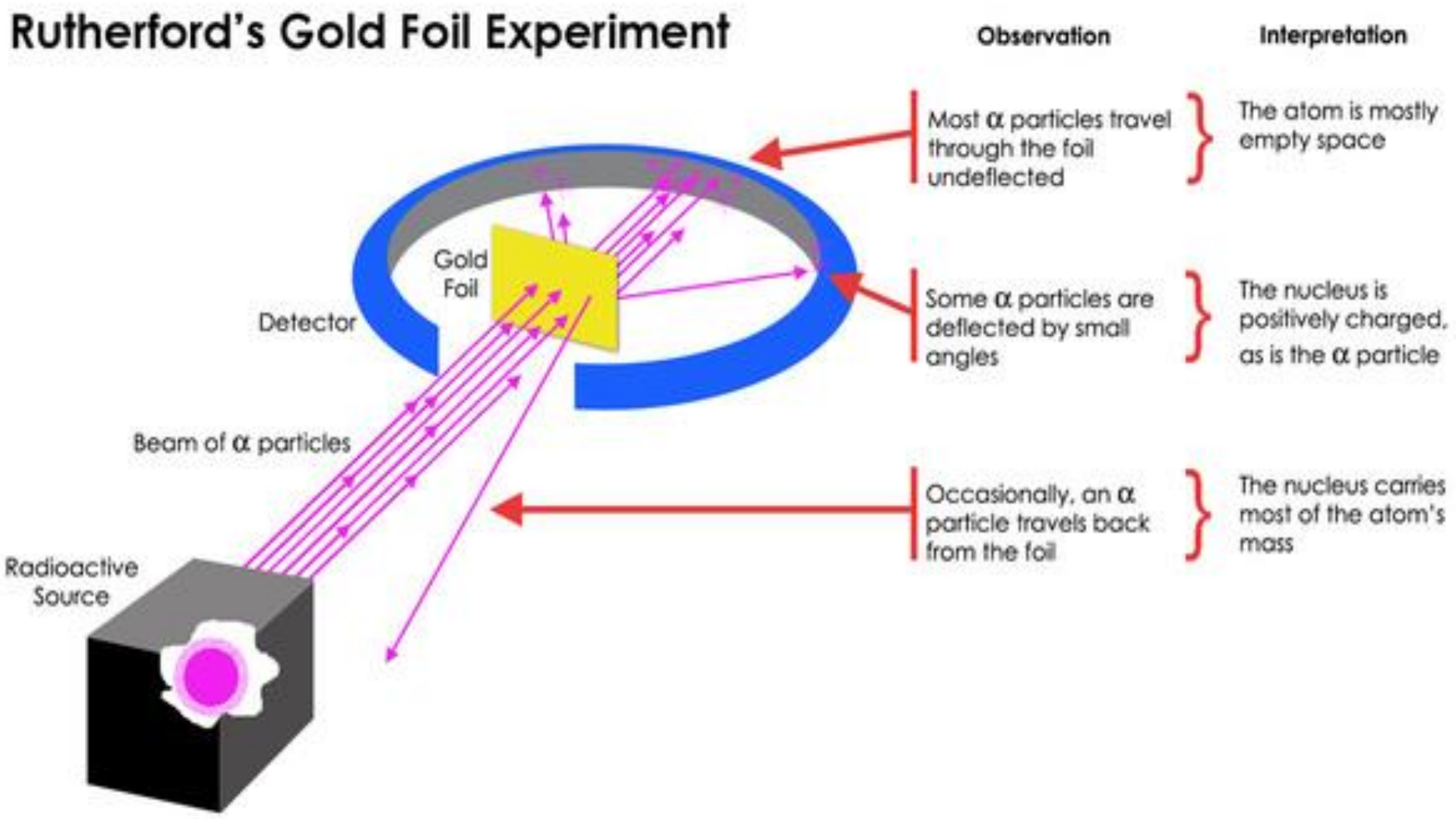
LESSON OBJECTIVES:7

- BY THE END OF THIS PART OF LESSON,STUDENTS WILL BE ABLE TO:
- Understand structure of an atom as predicted by Rutherford's experiment.
- Discovery of Nucleus of an atom.
- Rutherford's made some conclusion about the structure of an atom.

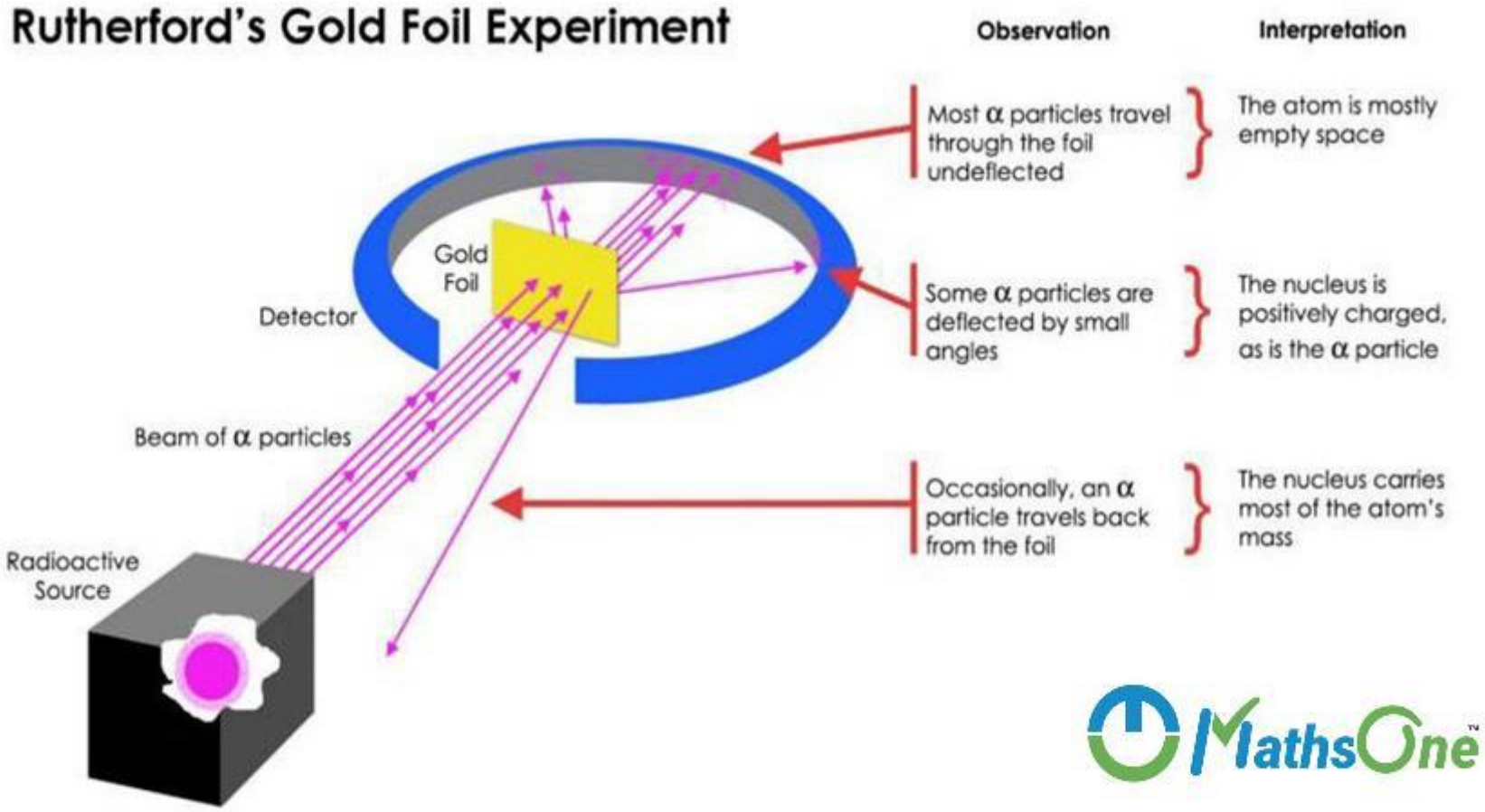
RUTHER'S EXPERIMENTS:



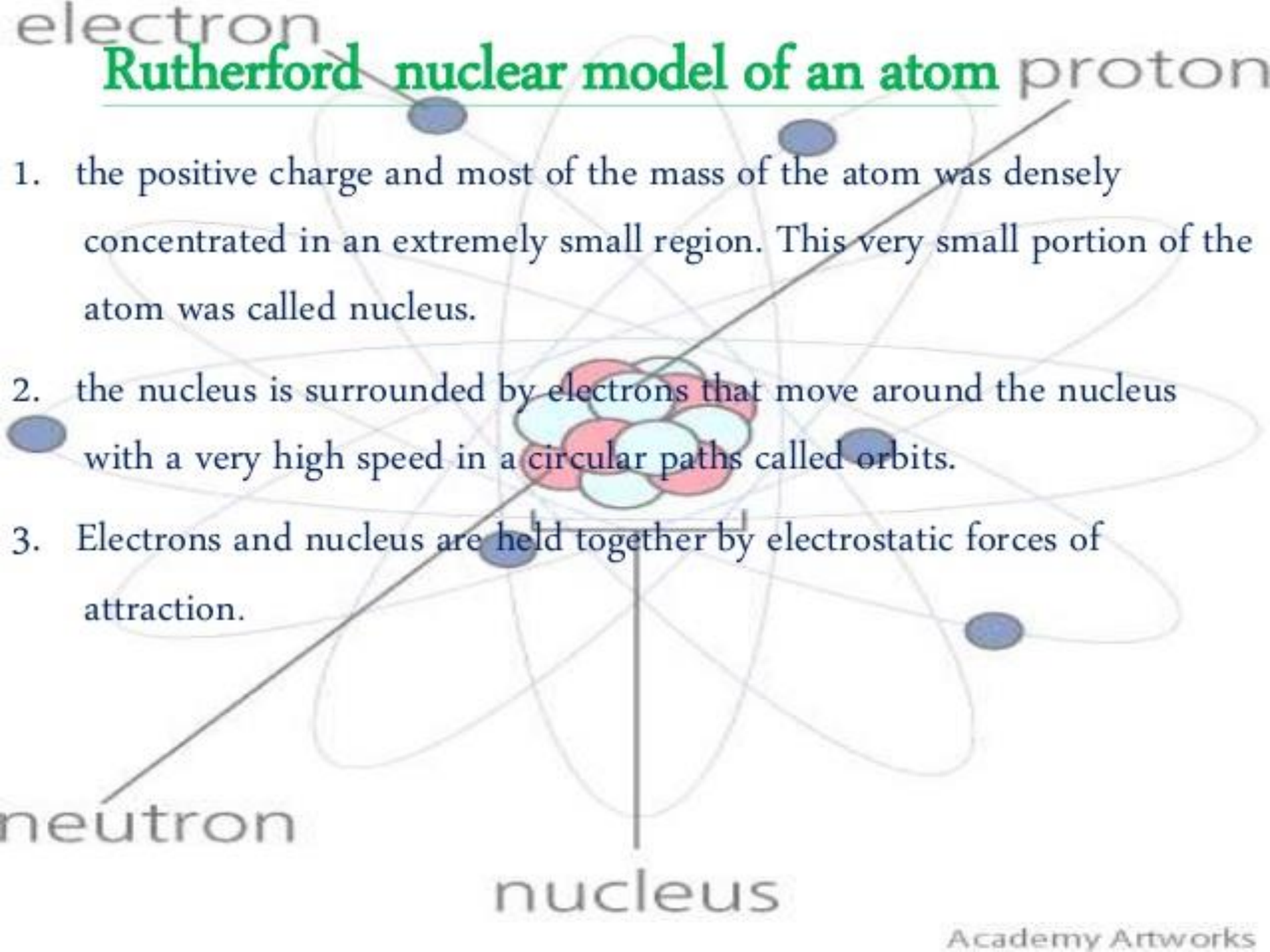
RUTHER'S EXPERIMENT:



The Discovery Of The Nucleus Of The Atom



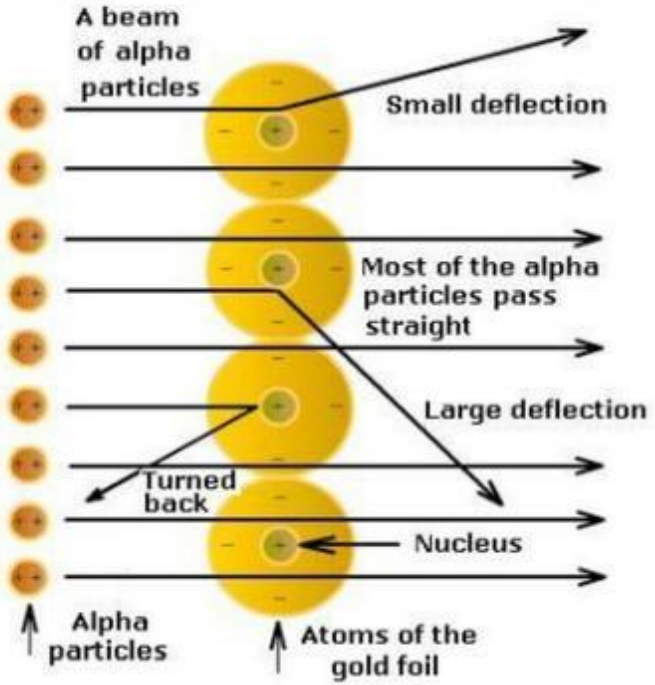
Rutherford nuclear model of an atom

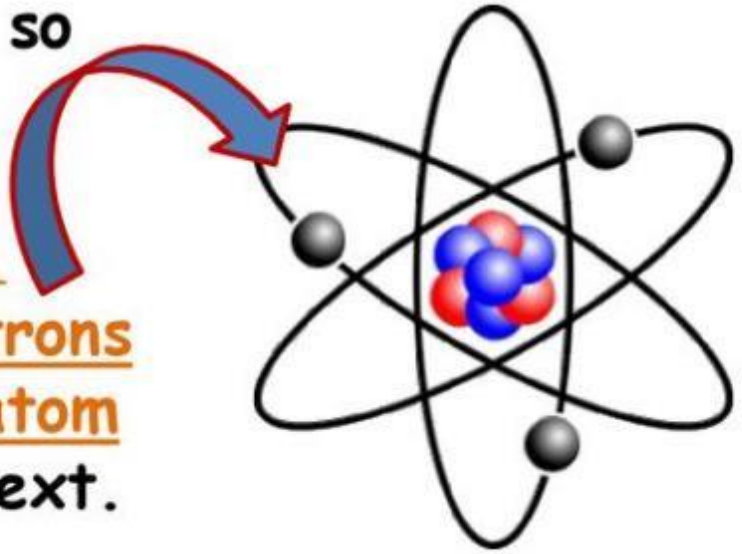


1. the positive charge and most of the mass of the atom was densely concentrated in an extremely small region. This very small portion of the atom was called nucleus.
2. the nucleus is surrounded by electrons that move around the nucleus with a very high speed in a circular paths called orbits.
3. Electrons and nucleus are held together by electrostatic forces of attraction.

Conclusions from α scattering experiment

1. The vast majority of α particles were not deflected at all: the atom must be mostly empty space
2. Some α particles deflected through large angles: there must be a very small nucleus with a positive charge with a large electric field near to its surface.
3. Alpha particles repelled: alpha particles are positively charged so the nucleus must be positively charged in order to create an electrostatic force of repulsion.
4. Atoms are neutral overall: electrons must be on the outside of the atom separating one atom from the next.





Conclusions from Rutherford's Gold Foil Experiment (memorize this!)

- The atom contains a positively charged "**nucleus**"

- This **nucleus** contains almost all of the **mass** of the atom, but occupies a very small **volume** of the atom.

- The negatively charged **electrons** occupied most of the volume of the atom.

- The atom is mostly **empty** space.

Conclusions:

- ✓ Most of the atom was empty space because most of the alpha particles went straight through.
- ✓ The nucleus was positively charged because the positive nucleus repelled the positively charged alpha particles.
- ✓ The mass of the atom was concentrated in the nucleus / the nucleus is very dense (not "large or heavy") because the alpha particles were repelled straight back / at large angles

.

DISCOVERY OF NUCLEUS:

- **Explain the discovery of Nucleus ?**
- **THE DISCOVERY OF NUCLEUS (RUTHERFORD'S EXPERIMENT:1910-11) :After the discovery of electron, proton and neutron, the next problem was to locate their positions. In 1910,Rutherford performed on Alpha particles scattering experiment.**
- **He bombarded alpha particles ($_2He^4$) from a radioactive element (Ra or Po) on a thin metallic (gold) foil (0.00004cm thick).**
- **He observed that the alpha particles were scattered in all the directions as seen by ZnS detector.The scattering was of three types:**
- **Some alpha particles went straight through the metal foil without any deflection.**
- **Whereas some alpha-particles (one in 20,000) were deflected away at various angles.**
- Very few-alpha- particles bounced back from the foil.

CONCLUSIONS:

- **RUTHERFORD'S CONCLUSIONS (RUTHERFORD'S ATOMIC MODEL)**
- An atom consist of a small, heavy,positively charged portion called nucleus.
- There is a negatively charged portion which surrounds the nucleus. This portion contains electrons .It is called extra-nuclear portion or planetary.
- The number of protons in the nucleus is equal to the number of electrons in the planetary.
- The electrons revolve around the nucleus.
- The centripetal force is equal to the electrostatic force between nucleus and electrons.
- Only a very small volume is occupied by the nucleus.

CONCLUSIONS DRAWN BY RUTHERFORD

- Rutherford concluded from the alpha particles scattering experiment that –

a) Most of the space inside the atom is empty because most of the alpha particles passed through the gold foil without getting deflected.

b) Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very little space.

Today's Learning

Don't forget to put your name on!

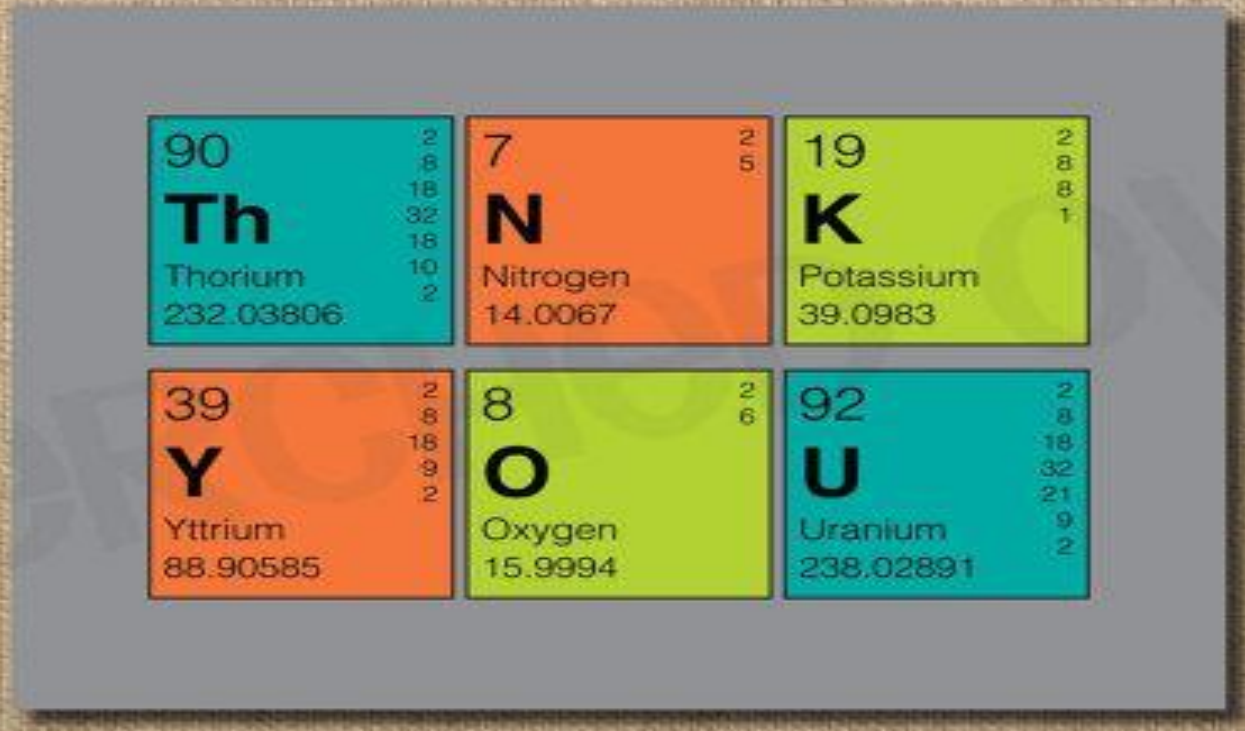
Something I can do now that I couldn't do before the lesson is...	A question I would like to know the answer to is...	I need to improve on...

HOME-WORK:

- NOTE:ATTEMPT ANY ONE QUESTION:
- Explain Rutherford's experiment?
- What conclusions were drawn by Rutherford's about his experiment?
- Explain the discovery of Nucleus?

LESSON CLOSURE:


good bye
good bye
SCHOOL BUS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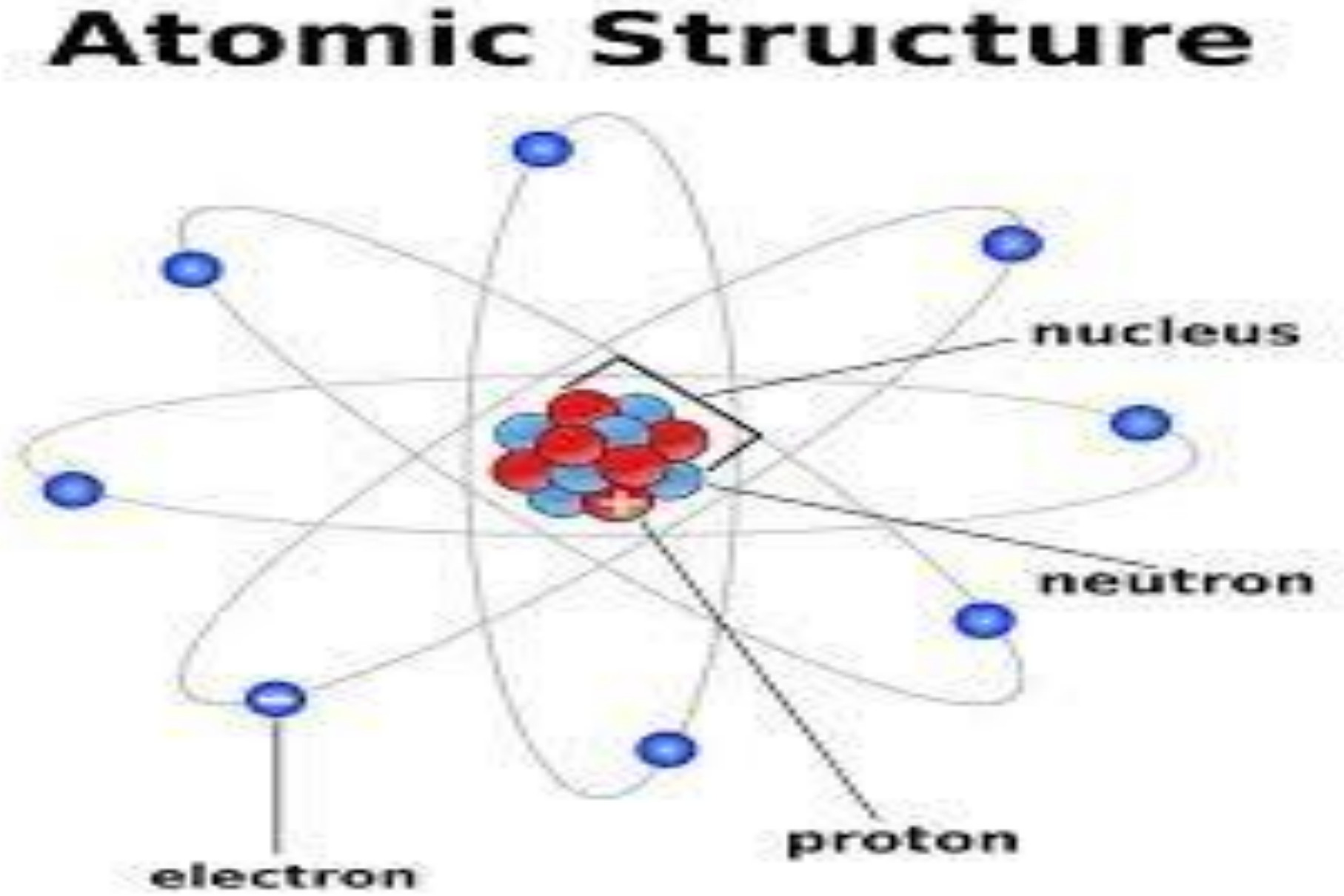

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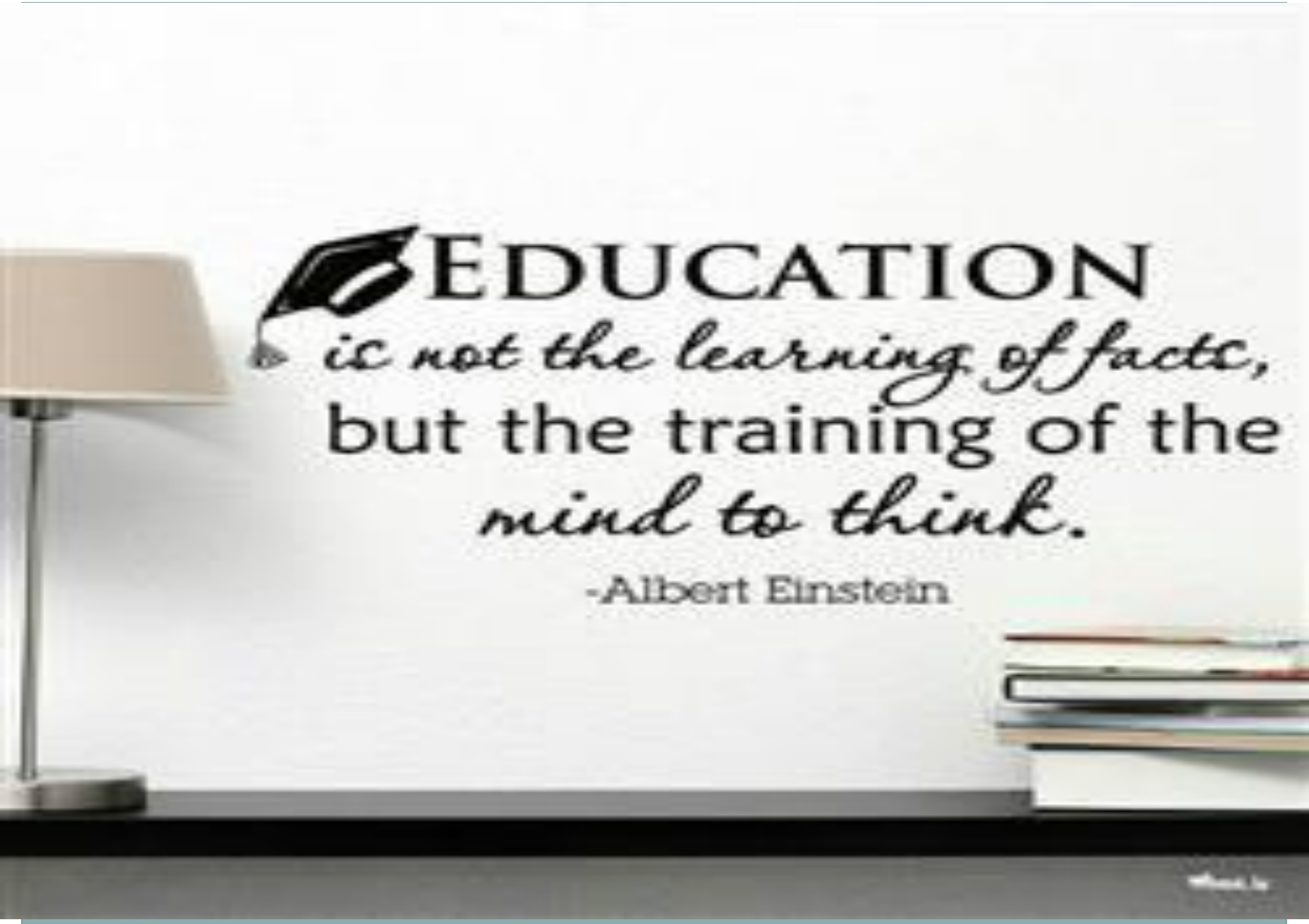
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LESSON OBJECTIVES:8

- BY THE END OF THIS PART OF LESSON,STUDENTS WILL BE ABLE TO:
- Understand defects of Rutherford's atomic model.
- Why Rutherford's atomic model has limitations.
- Properties of electrons, protons and neutrons.

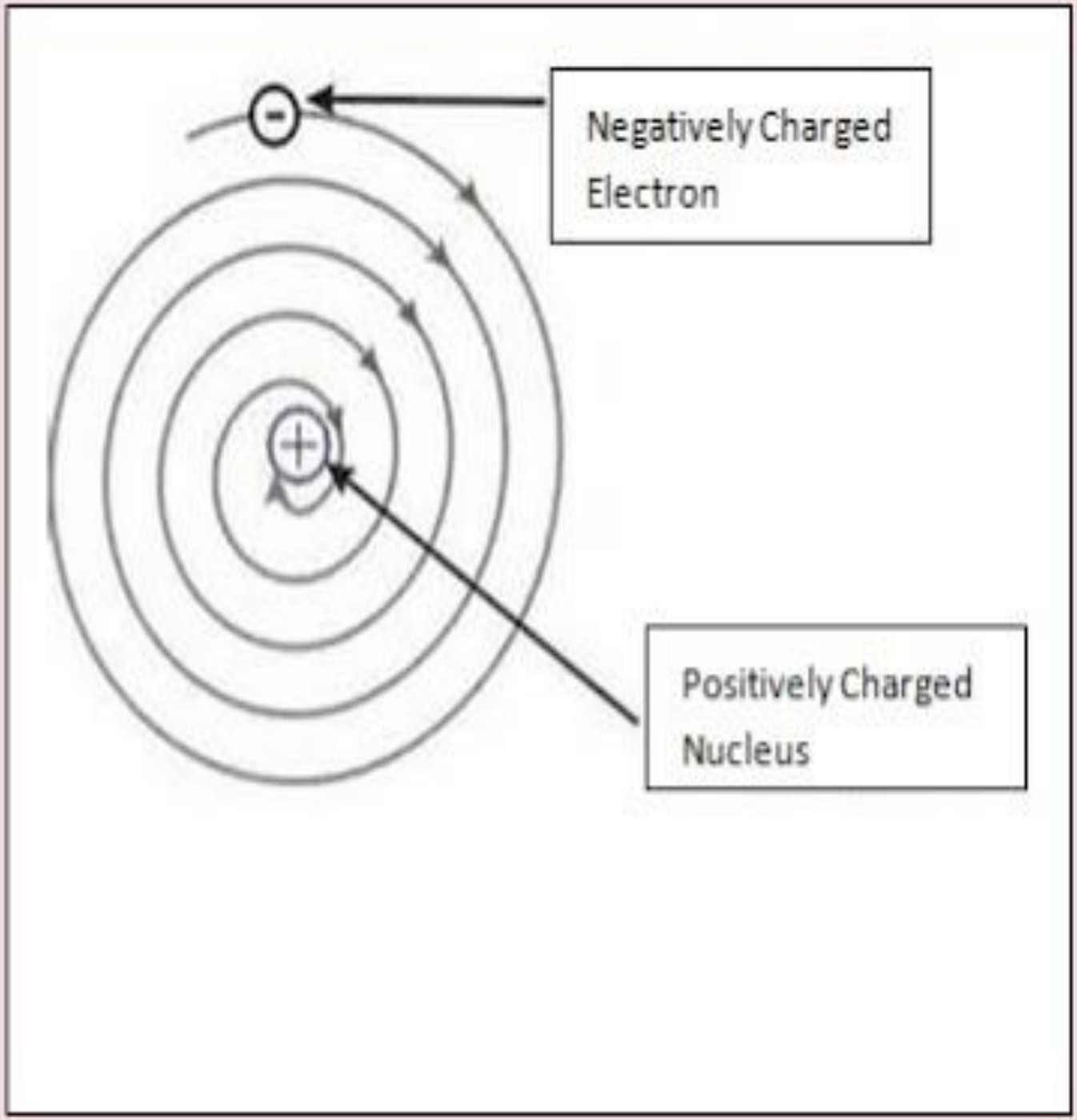
Drawbacks of Rutherford's Model

- **It could not explain the stability of the atom.** A/c to classical theory of mechanics, during uniform revolution, any body accelerates, & an accelerating charged particle must emit radiation, and lose energy. Due to the fact, the electron must emit radiation and lose energy. As a result, the electron will follow a spiral path, and ultimately fall into nucleus .So, Rutherford has given concept of unstable atom.

- The Rutherford's model of atom does not say anything about the arrangement of electrons in an atom.

Limitations of the Rutherford's Model

According to Rutherford's model of an atom, electrons revolve around the nucleus as planets revolve around the sun. But, electrons revolving in circular orbits will not be stable because during revolution, they experience acceleration. Due to acceleration, they will lose energy in the form of radiation arid fall into the nucleus. In such a cases the atom would be highly unstable and would collapse.



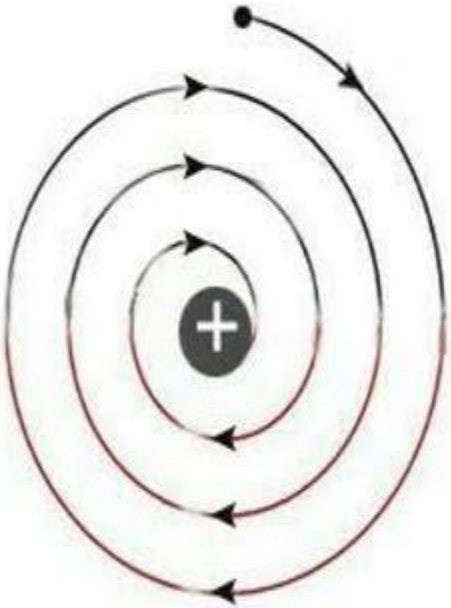
In this model, the negatively charged electron could fall into the nucleus. This does not happen actually.

DEFECTS:

- DEFECTS OF RUTHERFORD ATOMIC MODEL:
- Rutherford ‘s model is based upon laws of motion and gravitation. These laws can be easily applied to neutral bodies but not to the charged bodies such as electrons and protons.
- A revolving electron must emit energy continuously .As a result, electron will move in a spiral path and will fall into the nucleus. Thus, whole atom would collapse. However, it never happens.
- If electron emits energy continuously , then a continuous spectrum should be formed. Actually, atoms forms line spectrum.

Defects of Rutherford's Atomic Model

Atomic structure



continuous decrease in the energy of the electron

Defects of Rutherford's model of the atom :-

Any particle in a circular orbit would undergo acceleration and during acceleration the charged particle would radiate energy. So the revolving electrons would lose energy and fall into the nucleus and the atom would be unstable. We know that atoms are stable.