Q#7:- Explain with detail the discovery of nucleus?

OR

What is gold foil experiment?

Ans: Rutherford's Gold Foil Experiment / Discovery of Nucleus Experiment:

Rutherford's Experiment

Rutherford bombarded a thin gold foil (0.0004cm) thickness with alpha particles (α-particles). He observed that after bombardment

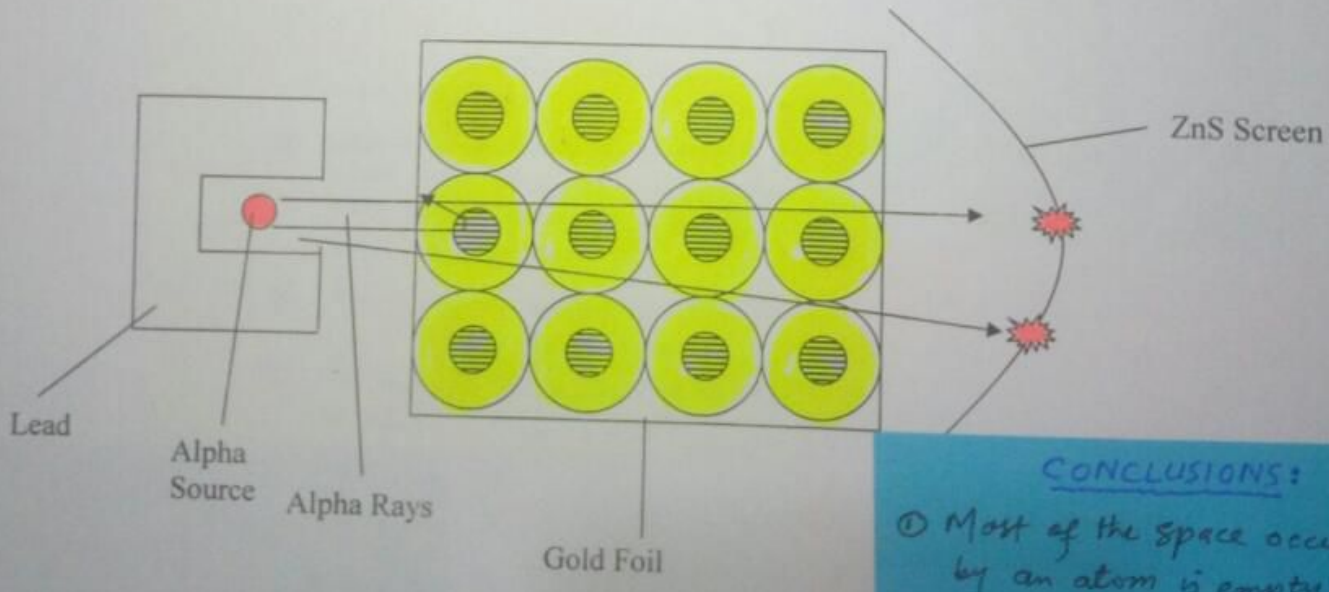
(i) Most of these particles passed straight through the foil.

(ii) Only few particles were slightly deflected.

(iii) One in one million were deflected through an angle greater than 90° from their path.

Note: Experiment was performed between 1908 and 1913 by Hans Geiger and Ernest Marsden under the direction of Ernest Rutherford at the Physical Laboratories of Manchester University

Magnified (Gold Foil)



CONCLUSIONS:

(i) Most of the space occupied by an atom is empty.

(ii) α-particles deflected through angles greater than 90° shows that a positively charged part is present in the centre of an atom

(iii) Massive α-particles are not deflected by electrons.

Q#11:- Write a detailed note on acid-base titration.

Ans: ACID-BASE TITRATION

(French# Titre means standard)

Definition:

"The process by which unknown concentration (molarity) of an acid or a base solution is determined by volume of a solution of known concentration is called acid-base titration."

Formula:

Following is the formula for the determination of acid-base titration.

Base	=	Acid
M_1V_1/n_1	=	M_2V_2/n_2

Procedure:

Suppose we want to know the unknown concentration (molarity) of HCl solution. So, we fill the burette with HCL and note the initial volume of HCl. Take $20cm^3$ of known concentration (molarity) of NaOH in a flask.

After it, we add few drops of phenolphthalein as an indicator in a flask . After adding phenolphthalein, the colour of the solution changes into dark pink. After this step, we add HCl solution from burette to the solution of flask drop and shake constantly. When the solution changes into light pink, stop adding HCl.

Chemical Equation:

Chemical equation for the reaction is:

But, as we know,

Base	=	Acid
M_1V_1/n_1	=	M_2V_2/n_2

OR

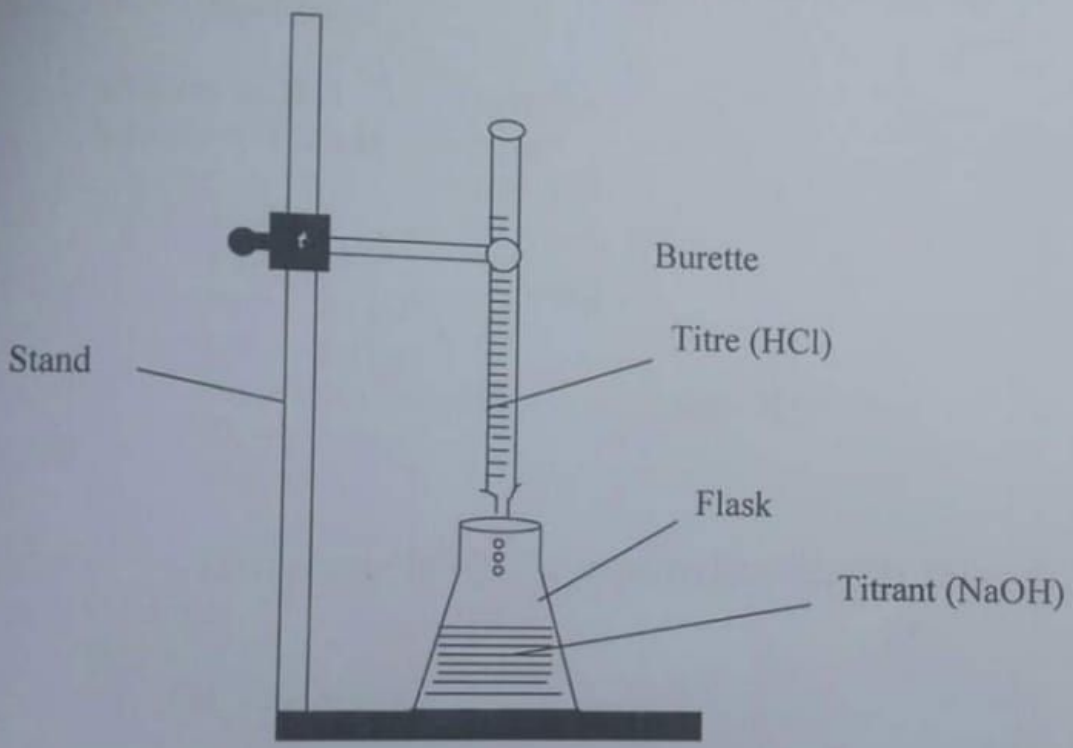
$$M2 = M_1V_1/n_1 \times n_2/V_2$$

Where

N_1 = The number of moles of NaOH
N_2 = The number of moles of HCl
V_1 = The volume of moles of NaOH
V_2 = The volume of moles of HCl
M_1 = The molarity of NaOH
M_2 = The molarity of HCl.

After putting the values of M_1, V_1, V_2, N_1 and N_2 we can calculate M_2.

Diagram:



Titre:

"The solution in the burette is called the titre."

Titrant:

"The solution which is taken in the flask in a titration is called titrant."

Indicator:

"It is the substance used to determine the end point of a chemical reaction."

Written By Mureed Abbas

OR

$$K\,[H_20] = [H^+]\,[\overline{OH}]$$

OR

$$K_w = [H^+]\,[\overline{OH}] \quad \text{——————} \quad (2)$$

Because the dissociation of water into ions is very small, therefore, the concentration of H_20 remains constant. This new constant (K_w) is called dissociation constant of water.

Value of K_w:

The value of K_w of water at $25C^o$ is $1.0x10^{-14}$.

$$K_w = [H^+]\,[OH] = 1.0x10^{-14}.$$

Because

$$[H^+] = [\overline{OH}]$$

Therefore

$$[H^+] = [\overline{OH}] = 1.0x10^{-7}.$$

Examples:

The molarity of aqueous solution of HCl is 0.1M. Find out the PH values of this solution (assume complete ionization)

Solution:

Reaction (ionization)

$$HCl \rightleftharpoons H^+ + \overline{Cl}$$

$$[H^+] = 0.1M$$

$$= 1/10 = 10^{-1}$$

As we know,

$$PH = -\log [H^+]$$

$$PH = -\log[10^{-1}]$$

$$PH = -(-1) = 1 \text{ Answer}$$

Examples:

(1) $(NH_4)_2SO_4$, $Al_2(SO_4)_3$, $24H_2O$
(2) K_2SO_4, $Cr_2(SO_4)_3$, $24H_2O$
(3) $(NH_4)_2SO_4$, $Fe_2(SO_4)_3$, $24H_2O$

Q#9:- What are the uses of salts?

Ans: USES OF SALTS

Some of the uses of salts are given as:

(i) Sodium Chloride:(Table Salt) is used in food.
(ii) Calcium Phosphate is present in the bones.
(iii) Potash alum is used to remove impurities from water. Potash alum is used in textile industry. Potash alum is used as blood coagulant.
(iv) Calcium phosphate dihydrate is often used in building materials.
(v) Soduim carbonate is used for cleaning purposes. It is also used in glass industry, leather industry and petroleum refining industry.
(vi) Copper sulphate is used to kill algae in water.
(vii) Magnesium sulphate is used as laxative in medicines.
(viii) Sodium bicarbonate is used in toothpaste.

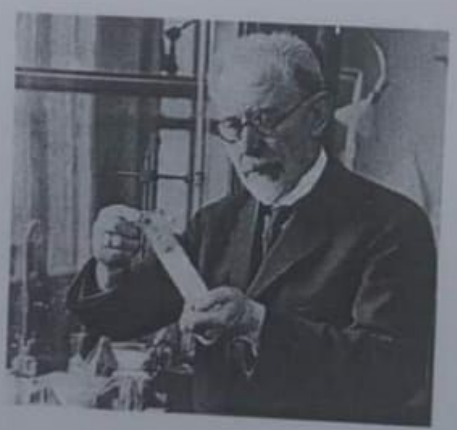
Q#10:- Write a detailed note on PH.

Ans: PH

Definition:

"It is the negative of the logarithm of the hydrogen ion (H^+) concentration."

Explanation:



A scientist named Sorenson (1909) devised a simple number scale based on H^+ ion concentration of the solution. It is called PH scale.

Mathematically:

In mathematical terms:

$$PH = - \log [H^+]$$

An equation for the ionization of water is:

$$H_2O \rightleftharpoons H^+ + \overline{OH}$$

The expression for the equilibrium constant for this reaction is given as:

$$K = \frac{[H^+]\,[\overline{OH}]}{[H_20]}$$

(i) **NORMAL SALTS:** (عام نمکیات)

"Salts formed when hydrogen ions of an acid are completely replaced by metal ions."

OR

"These are those slats which produce neutral solution in water."

Example:

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

(ii) **ACIDIC SALTS:** (تیزابی نمکیات)

"Salts formed when hydrogen ions of an acid are partially replaced by metal ions."

OR

"These are those salts which in aquous solutions liberate (H^+) ions."

Example:

$$H_2SO_4 + NaOH \longrightarrow NaHS0_4 + H_2O$$

(iii) **BASIC SALTS** (اساسی نمکیات)

"Salts formed when ($\overline{OH}$) ions of a base are partially replaced by an acid."

OR

"These are those salts which in aquous solutions liberate ($\overline{OH}$) ions.

Example:

$$HNO_3 + Pb(OH)_2 \longrightarrow Pb(OH)NO_3 + H_2O$$

Q#8:- What is meant by double salts?

Ans: SOUBLE SALTS (دوہرے نمکیات)

Definition:

"A substance formed by the combination of two salts along with definite water molecules is called a double salt."

OR

"Such salt which contain the crystals of more than one single salt is called a double salt."

Explanation:

Double salts are formed by dissolving two types of salts in water in a simple mole ration. The chemical properties of these crystals remain the same as the component salts but their physical properties change.

3- Lewis Concept

In 1923, Professor G.N. Lewis, an American chemist put forward a new concept to define an acid and a base. According to Lewis concept:

Lewis Acid:

"Acid is a substance which has the ability to accept a pair of electron."

OR

"Lewis acid is an electron pair acceptor."

Examples:

$AlCl_3$, BF_3, H_3O^+ are Lewis acids because they can accept electron pair.

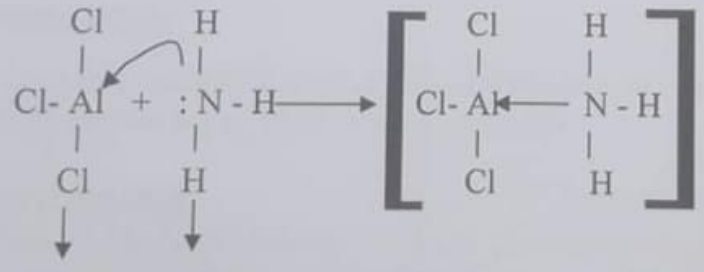
Lewis Base:

According to Lewis "Base is a substance which has the ability to donate a pair of electron."

According to this concept, the electron pair is donated by the base to the acid and a co-ordinate covalent bond is formed between the two.

Examples:

OH^-, F^-, NH_3, CaO etc



Q#2:- (a) What do you meant by a strong acid and a weak acid?
(b) What is meant by a strong base and a weak base?
(c) Name some common acids and bases?

Ans: (a) STRONG ACID:

The Acid in which ionization is almost complete is called a strong acid.

The strength of an acid depends upon the number of hydrogen ions (H^+) or protons produced in water. Greeter the number of (H^+) ions produced by an acid, stronger will be the acid.

e.g.

(1) HNO_3 (Nitric acid)
(2) HCl (Hydrochloric acid)
(3) H_2SO_4 (Sulfuric acid)

WEAK ACID:

The acids which don't ionize completely are called weak acid.

e.g.

(1) CH_3COOH (acetic acid)
(2) H_2CO_3 (Carbonic acid)
(3) HCOOH (Formic Acid)

(b) STRONG BASE:

Bases which ionize almost completely in water are called strong bases.

Strength of bases depends upon the number of hydroxyl ions (OH^-) in water.

Greater the number of (OH^-) produced by the base in water, stronger is the base.

e.g.

NaOH (Soduim Hydroxide)

WEAK BASE:

Bases which don't ionize complete in the water are called weak bases.

e.g.

NH_4OH (Ammonium Hydroxide)

(c) COMMON ACIDS AND BASES:

Common Acid:

HCl (Hydrochloric acid), H_2SO_4 (Sulfuric acid), HNO_3 (Nitric acid), CH_3COOH (acetic acid), H_2CO_3 (carbonic acid)

Common Bases:

NaOH (Soduim Hydroxide), KOH (Potassium hydroxide), NH_4OH (Ammonuim hydroxide), $Ba(OH)_2$ (Barium hydroxide), $Fe(OH)_3$ (Feric Hydroxide).

Q#3:- Write physical acid chemical properties of acids?

Ans: PHYSICAL PROPERTIES OF ACIDS

(1) They possess a sour taste.
(2) They turn blue litmus paper red and methyl arranges paper red.
(3) Their aquous solutions conduct electricity.
(4) Strong acids like H_2SO_4, HNO_3 destroy fabrics, animal tissues and skin.
(5) Gastric juicy of stomach contains 0.2 to 0.4% of HCl which helps in digestion and acts as an antiseptic.

CHEMICAL PROPERTIES OF ACIDS:

(1) Acids react with bases to form salt and water. The process is called Neutralization.

$$H\overset{+}{Cl} + \overset{+}{Na}\overset{-}{OH} \longrightarrow NaCl + H_2O$$

Q#1:- (a) What is an Acid?
(b) Name some naturally occurring Acids?
(c) What is a Base?

Ans: (a) ACID (تیزاب)

The work acid is derived from a Latin word acidus that means "sour." e.g. CH_3COOH (acetic acid), HCOOH (formic acid). Acid is defined as:

"A compound which gives hydrogen ion (H^+) in aquous solution."

$$HCl \rightleftharpoons H^+ + Cl^-$$

(b) Some Naturally occurring Acids:

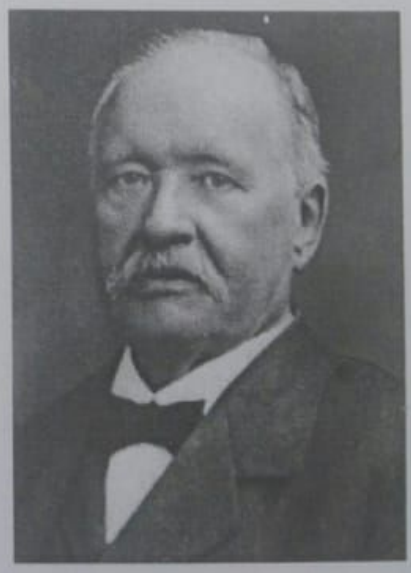
(1)	Acetic acid	(occurs in vinegar)
(2)	Tartaric acid	(occurs in grapes)
(3)	Citric Acid	(occurs in lemon)
(4)	Lactic acid	(occurs in fermented milk)
(5)	Formic acid	(occurs in strings of bees)
(6)	Hydrochloric acid	(occurs in gastric juice)

(c) BASE (اساس)

"A base is a substance which in solution forms, gives hydroxyl ions ($\overline{OH}$)."

e.g. NaOH, KOH, $Ba(OH)_2$, $Ca(OH)_2$

1- Arrhenius Concept



Swedish scientist, Arrhenius presented the following concept about acids & bases.

ACIDS:

"All those substances which produce hydrogen ion (H^+) or a proton in water is called acid."

e.g.

$$HCl + aq \rightleftharpoons H^+ + Cl^-$$

$$H_2SO4 + aq \rightleftharpoons 2H^+ + SO_4^{-2}$$

$$HNO_3 + aq \rightleftharpoons H^+ + NO_3^-$$

BASES:

" Base is a substance that produces (OH^-) ions in water."

e.g.

$$NaOH + aq \rightleftharpoons Na^+ + OH^-$$

$$KOH + aq \rightleftharpoons K^+ + OH^-$$

2- Lowery-Bronsted concept

In 1913, lowery and Bronsted presented the concept of acids and bases. According to this concept:

ACID:

"Acid is a compound which donates a proton."

OR

"Acid is a proton donor."

BASE:

"Base is a compound which accepts proton."

OR

"Base is a proton accepter."

EXPLANATION:

According to lowery-Bronsted concept, the ionization of an acid can be represented as follows:

$$\underset{\text{(Acid)}}{HA} + \underset{\text{(Water)}}{H_2O} \rightleftharpoons \underset{\text{(Base)}}{A^-} + \underset{\text{(Hydronuiem ion)}}{H_3O^+}$$

Examples:

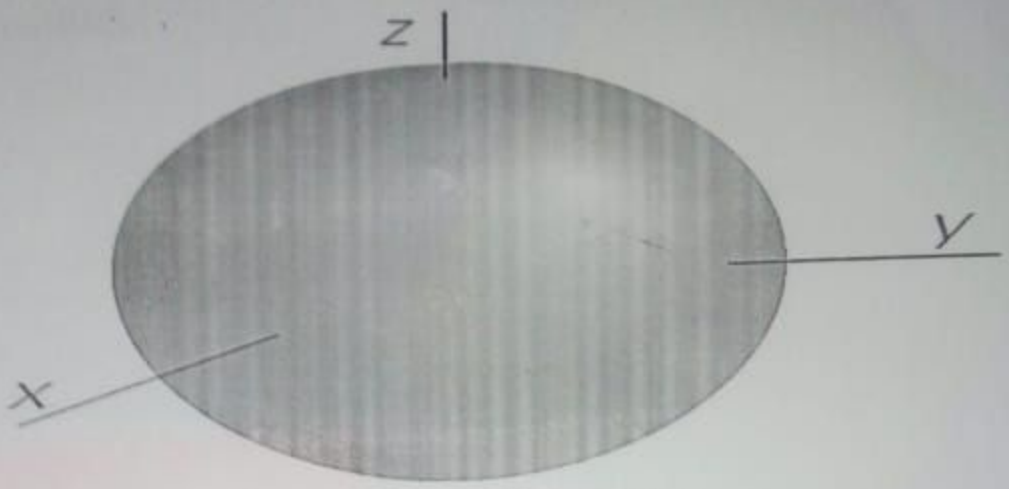
(1) In case of hydrochloric acid (HCl)

$$HCl + H_2O \rightleftharpoons Cl^- + H_3O^+$$

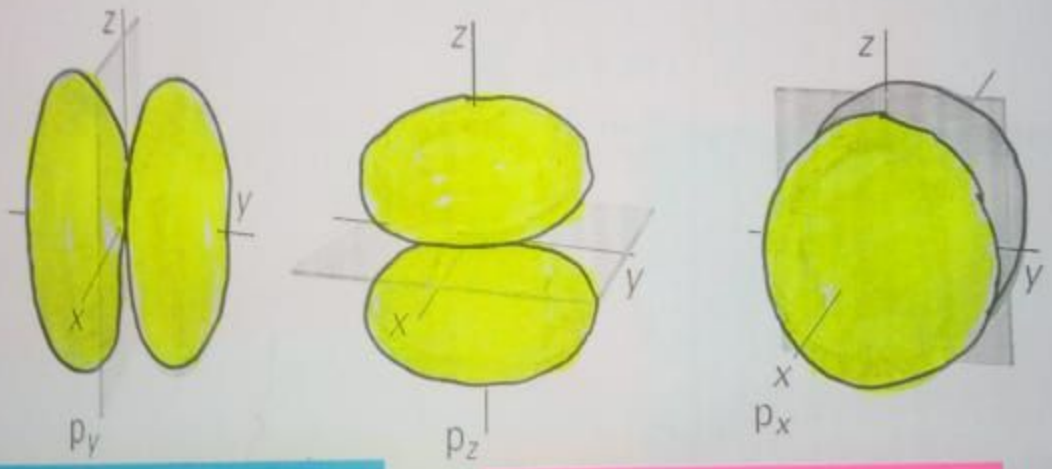
According to the definition Cl^- is a base because it has the ability to accept proton. It is called the conjugate base of HCl.

(2) In case of acetic acid (CH_3COOH) acetate ion (CH_3COO^-) is the conjugate base of
Acetic acid.

$$CH_3COOH + H_2O \rightleftharpoons \underset{\text{Conjugate Base}}{CH_3COO^-} + H_3O$$



S - ORBITAL



Auf Bau Principle

According to Auf Bau Principle:

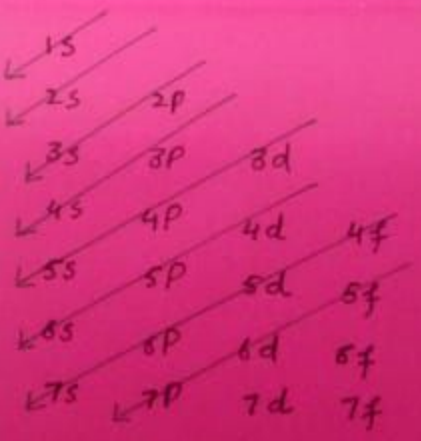
"Electrons fill the lowest energy levels first."

For example:

The increasing order of energy of the sub-shells is:

1S < 2S < 2P < 3S < 3P < 4S < 3d

Diagonal rule for the electronic configuration



- Shell
- Sub-shell
- $2n^2$ formula
- Electronic configuration

SHELL

The electron in an atom revolves around the nucleus in circular paths called shells. It is represented by (n). Where

$n = 1, 2, 3, 4$
$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
$K \quad L \quad M \quad N$

Sub-Shell

A shell is subdivided into Sub-shells or Sub-energy levels. e.g

S, P, d, f

Maximum number of $\bar{e}$s are accomodated like
S = 2, P = 6, d = 10, f = 14

⇒ What is $2n^2$ formula.

Number of electrons in any Shell (n) can be found by $2n^2$ formula. e.g.

If $n = 2$

No. of electrons $= 2n^2$
$= 2(2)^2$
$= 8$ electrons

Electronic Configuration of Hydrogen (H)

Q. How many isotopes of Carbon? Discuss.

Ans: Carbon has three isotopes:

① C-12: (Six neutrons and Six protons). $^{12}_{6}C$

② C-13: (Seven neutrons and Six protons). $^{13}_{6}C$

③ C-14: (Eight neutrons and Six protons). $^{14}_{6}C$

Q. How many isotopes of Chlorine

Ans: Chlorine has two isotopes.

① Cl-35: $^{35}_{17}Cl$

(18 neutrons and 17 protons)

② Cl-37: $^{37}_{17}Cl$

(20 neutrons and 17 protons)

Q: Discuss isotopes of Uranium.

Ans: Uranium has three isotopes.

① U-235: $^{235}_{92}U$

(143 Neutrons and 92 protons).

② U-234: $^{234}_{92}U$

(142 neutrons and 92 protons).

③ U-238: $^{238}_{92}U$

(146 neutrons and 92 protons)

Q: What is Carbon dating?

Ans: C-14 is used to estimate the age of carbon containing substances. Carbon atoms circulate b/w the oceans and living organisms at a very much faster than they decay. As a result the concentration of C-14 in all living things keep on increasing. After death no longer pick up of C-14

CHAP#2 **ATOMIC STRUCTURE** ایٹمی ساخت

Q#11:- (a) Write a detailed note on isotopes? Refer it with the example of hydrogen?

(b) What are the uses of isotopes?

Ans: Isotopes (Greek, ISO= Equal , Top = place /At-Number) ہم جاء

Definition:

"Atoms of an element having same atomic number but different mass number are called isotopes".

OR

"Atoms of an element having different number of neutrons are called isotopes."

Example, (Hydrogen)

There are three isotopes of Hydrogen.

(1) Protium

(2) Deutruim

(3) Trituim

(1) **Protium:** (Greek Pro means first)

It is also called ordinary hydrogen. Its atomic number and mass number is one.

(2) **Deutrium** (Greek Di means second)

It has atomic number one and atomic mass two. It is heavy hydrogen.

(3) **Tritium** (Greek Tri means three)

It has atomic number
One and atomic mass three.

Uses of the Isotopes:

(1) **Iodine-131:**

It is used in the treatment of goiter گلہڑ

(2) **Radium & Cobalt:**

The rays of radium and cobalt are used for the treatment of cancer.

(3) **Deutrium:**

It is used as tracers (پتہ لگانے والا) in many biological research works.

(حیاتیاتی تحقیقی کام)

(4) **Sodium-24:**

It is used in the detection of problems of blood (Circulation).