

# 8. HYDROGEN & ITS COMPOUNDS

## STUDY NOTES

### I) HYDROGEN(H)

#### 1) Isotopes of Hydrogen :

(i)  ${}_1\text{H}^1$  or H (Hydrogen or Protium) (ii)  ${}_1\text{H}^2$  or D (Deuterium) (iii)  ${}_1\text{H}^3$  or T (Tritium).

#### 2) Physical properties of Hydrogen :

(i)  $\text{H}_2$  is Colourless, Odourless & Tasteless gas (ii) It is slightly **soluble** in water  
(iii)  $\text{H}_2$  is lightest gas known ever (iv)  $\text{H}_2$  can be **liquefied** under high pressure and low temperature

#### 3) Chemical properties of Hydrogen :

(i)  $\text{H}_2$  is highly **Combustible**

(ii) Hydrogen is chemically **less reactive**

(iii)  $\text{H}_2$  is **neutral** in nature and hence it shows 'no action' on 'Litmus'.

(iv) Hydrogen combines with many **non-metals** like Halogens,  $\text{O}_2$ ,  $\text{N}_2$ , S, C.

(v) Hydrogen combines with Metals like Sodium (Na), Potassium (K), Calcium (Ca).

#### 4) Preparation of Hydrogen:

(i) **Electrolysis** of water gives Hydrogen (ii) from **Water gas**.

(iii) It is a **by product** in the manufacture of **Caustic soda** (NaOH)

(iv) from **Acids** (v) from **Petro chemicals**

#### 5) Uses of Hydrogen:

(i) Source of energy **as a fuel** (Coal gas, Water gas, Semi water gas, Carburetted water gas)

(ii) Source of Atomic energy (Nuclear Fusions of Hydrogen bomb, Sun, Stars)

(iii) Metallurgy (Pure metals like Molybdenum, Tungsten using  $\text{H}_2$ )

### II) WATER( $\text{H}_2\text{O}$ )

Water is known as **Universal solvent** because most of the substances dissolve in water.

#### 1) Physical properties:

(i) Water is colourless, tasteless, odourless. (ii) Its melting point is  $0^\circ\text{C}$  and B.P is  $100^\circ\text{C}$ .

(iii) The bond angle of  $\text{H}_2\text{O}$  molecule is  $104.5^\circ$  and bond length of O-H bond is  $0.957 \text{ \AA}$ .

(iv) Ice is the crystalline form of water. Ice floats on water because of its low density.

#### 2) Chemical properties of water :

(i) Water is highly stable.

(ii) Water is Amphoteric (behaves like acid as well as base).

(iii) Water under suitable conditions, reacts with non metals like Halogens and Carbon.

(iv) Water reacts with both **basic oxides** and **acidic oxides**.

(v) Water reacts with Anhydrous salts to form Hydrated salts.

(vi) A basic biological reaction of water is **Photosynthesis**.

(vii) Water under goes Hydrolysis

### 3) Types of Water on the basis of Hardness: (i) Soft water (ii) Hard water

**Soft Water** gives stable **lather** readily with soap solution.

**Hard Water** **does not** give stable **lather** readily with soap solution.

**Temporary hardness** of water is due to the presence of **bicarbonates** of **Ca & Mg**.

It can be removed by Boiling (or) adding milk of lime (Clarke's process).

**Permanent hardness** of water is due to **dissolved salts of Chlorides & Sulphates** of **Ca & Mg**.

It can be removed by Permutit process, Calgon process and ion-exchange method.

### III) HEAVY WATER(D<sub>2</sub>O)

It is the liquid state of Deuterium oxide D<sub>2</sub>O.

'Minute quantities' of D<sub>2</sub>O is present in

- (i) The leaves of Banyan trees (ii) Rain water (iii) 'Remains' of melting of 'Snow'.
- (iv) 6000 parts of ordinary water contains one part of D<sub>2</sub>O.

#### 1) Properties :

Physical properties of Heavy water, deviate slightly to some extent, from that of ordinary water.

But the chemical properties are same as that of water.

The process of reaction of Heavy water with salts is called **Deuterolysis**.

#### 2) Preparation :

Heavy water is obtained by the electrolysis of Aq. sol. of NaOH in a steel cell.

#### 3) Uses :

Heavy water is used as a **Moderator** of neutrons in atomic reactors.

Heavy water is used as a **Tracer** compound (for studying the mechanisms of reactions).

Heavy water is used as germicide and bactericide. It is used in the preparation of Deuterium.

#### 4) Negative effects of heavy water:

Heavy water is **Poisonous**. It **retards** the **growth** of plants and animals.

Seeds donot germinate in heavy water. Small fish die in heavy water.

**BULLET MASTER'S**  
**CHEM BEATS!**

[1SAQ]

**Hi Dudes!**

**Welcome to INORGANIC CHEMISTRY!**

Our Inter Chemistry is divided into Physical, Inorganic & Organic Chemistry

Some Students say Physical chemistry is easy !

Inorganic chemistry is Medium!! , Organic Chemistry is hard / outstanding!!!

Anyhow, most of the students feel 'Inorganic chemistry is easy to understand and remember'.

Inorganic Chemistry, mainly deals with 'Non -Carbon Compounds' whereas

Organic chemistry deals with 'Compounds of Carbon and its best friends Hydrogen, Oxygen'.

Inorganic ని చదవడాన్ని కొంత మంది కొంచెం లైట్గా తీసుకుంటారు !

కాని ఒక్కో Element యొక్క Background History కొంతైనా తెలుసుకుంటూ చదువుతుంటుంటే...

వామో! దీనికి ఇంత 'సీన్' ఉందా! అని ఫిదా అవ్వడం భాయం!!

కావాలంటే Hydrogen & Its Compounds యొక్క CHEM BEATS ని చదివి చూడండి...

మీరంతా Hydrogen కి పక్కా Fans అవుతారు !

**Dear STUDENTS!**

ఏది ఏమైనా, ఏ Chapter ఎలా ఉన్నా కూడా.... Students Reading Attitude ఎలా ఉండాలంటే....

ఒక్కో Chapter చదువుతుంటే మీకు మస్తు మజా రావాలి!

ఒకసారి చదివిన దాన్ని బాగా గుర్తుంచుకొనేలా.... అవసరమైనప్పుడు వెంటనే గుర్తుకువచ్చేలా చదవాలి!!

క్లిష్టమైన concepts ను లోతుగా అర్థం చేసుకుంటూ, విశ్లేషించుకుంటూ

చదువుతుంటే మీ నరనరాల్లో ఉత్సాహం ఉప్పొంగాలి !!!

**Few things about INORGANIC!**

**Father of Inorganic Chemistry: Alfred Werner**

**Types of Inorganic Compounds: Acids, Bases, Salts, Water**

**Most popular Inorganic Compounds: H<sub>2</sub>O, O<sub>2</sub>, NH<sub>3</sub>, NaCl, HCl, H<sub>2</sub>SO<sub>4</sub>, OH<sup>-</sup>, H<sub>3</sub>O<sup>+</sup>...**

Along with 'carbonless compounds', in inorganic we also study some carbon compounds like

CO, CO<sub>2</sub>, , calcium carbide CaC<sub>2</sub>, silicon carbide SiC....

Inorganic Chemistry లో ఉన్న Chapters అన్నీ ఒకేసారి నేర్పించడం భావ్యం కాదు కావున ....

**Jr. Chemistry లో Hydrogen & Its compounds, s- block, p-block (G-13, G-14) ఉంటే**

**Sr. Chemistry లో p-block G-15, G-16, G-17, G-18 మరియు d & f- Block ఉన్నాయి.**

H → No. 1 → H

**CHEM BEATS!**

H → Hello Happy !!

H → Hi Happy !!

H → SON of SUN

H → STAR of STARS

H → **Universal King & Queen**

H → Nuclear Fusion Friend He: Mr. Heat Energy

H → Water(H<sub>2</sub>O) Friend O: Miss. Cool Cool

H → Hydrogen Bomb: Most Powerful Bomb on the Earth

H → Most abundant (74%) element in the Universe

H → H Car (zero emission fuel)

H → H Rocket fuel gas

H → **H,C,N,O** [Four Organic elements]H → H<sup>+</sup> [Hydron cation]: Symbol of Proton- The 'no neutron' element - ProtiumH → H<sup>-</sup> [Hydride anion with an 'extra electron'. ]

H → All First element ! First Group and First period element in the Periodic Table.

H → Dual Natured Element like 'Sivaparvathi'. If you ask its Residential Address, it says .....

H → I live in Group 1 ..... But I would also love to live in Halogen Group! .

H → Do you ever understand the phrase 'Small is Big' (or) 'Smallest is the Biggest'. Here you go...

H → The smallest element H in the Universe occupies the Biggest space in the Universe.



**ALWAYS**  
**BE HAPPY**

BABY BULLET-Q

**BULLET MASTER'S**  
**CHEM BEATS!**

**ATOMIC NUMBER Vs VALENCY- ఏది గొప్ప?**

“ఒక వ్యక్తి వద్ద ఎంత ఆస్తులు ఉంటే ఎవడికి గొప్ప? ఇతరులకు సహాయం చేసే గుణం లేనప్పుడు!”  
“ఆస్తులు బాగా ఉన్న వారికన్నా తమకున్న ఆస్తిలో కొంచెమైనా పదిమందికి పంచే గుణం ఉన్నవాడే గొప్ప వ్యక్తి!!”

Chemistry లో అలా పదిమందికి ‘ఇచ్చిపుచ్చుకునే గుణమే’ Valency of Elements.

మన Hydrogen సంగతి చూడండి! దానికి ఉన్నది ఒకే ఒక్క Electron.

అవసరమై అడిగితే H తనకున్న ఒకే ఒక్క Electron ని కూడా Happy గా ఇచ్చేసి  $H^+$  గా మారుతుంది.  
కావాలనుకుంటే H మరో Electron ని ఎటువంటి మోహమాటం, Ego లేకుండా తీసుకొని  $H^-$  గా మారుతుంది.

This tendency made Hydrogen very friendly to most of the elements !

**H has so many 'Whatsapp Friends' Groups:  $HCl$ ,  $H_2O$ ,  $NH_3$ ,  $CH_4$ ,  $H_2SO_4$ ,  $H_3O^+$ ,  $OH^-$**

**H → Discoveror - Henry Cavendish.**

తన కాలంలో British Kingdom మొత్తం లో Richest Scientist -Henry Cavendish.

అతడు ధనికుల్లో కెల్లా విద్యాధికుడు! విద్యాధికుల్లో కెల్లా ధనికుడు!! ఎటువంటి విద్యా అహంకారం, ధనగర్వం లేని మేధావి.

'Weight of Earth Experiment' చేసిన Great Scientist!

Cambridge University లో ఉన్న Cavendish Lab ఇతనిదే!

Cavendish Lab లో పరిశోధనలు చేసిన Super Scientists;

J.J. Thompson, Maxwell, Rutherford, L.Bragg, James Watson, Stephen Hawkin,....