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'Position of Hydrogen' ABig Mistry of Periodic Table

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ABSTRACT

As Periodic table consists similar elements in same group but It is always confusing to make grouping of Hydrogen in periodic tableas it is similar to three groups of periodic table. in Sir DamitriMendeleev's periodic table Hydrogen stands at both in group I (Alkali Metals) as well as group VII (Halogens) due to the similarities in their oxide and hydride formation Were quite similar with the other members of group.Again, in modern periodic table had fixed the Hydrogen position in only first group where the valence shell electronic configuration is similar with elements of group I. Many properties are similar with these both group elements but not actually all. One another group is available that resemble with the Hydrogen in properties i.e. carbon family and can say that it is one of the third group from which the Hydrogen can exist, in other words can say that Hydrogen is an element always travels in periodic table from group I i.e. alkali metals to group VII 'A' i.e. Halogens but it is too far that Hydrogen takes rest at mid-point of the path i.e. group IV 'A' Carbon family.

Key words-*Periodic table, Hydrogen, Peripatetic, Position, Configuration, Mid- point, always travel.*

INTRODUCTION

Position of hydrogen is a big Mistry that if it has placed according to their valence shell electron configuration ie $1S^1$ similar to that of Alkali Metals ns^1 then question arises Helium is one of theelement that has valence shell electron configuration $1S^2$similar to that of alkaline earth metals ns^2. but ionization energy of Helium is very high comparable to that of noble gases so Helium took position in group VIII A (18^{th} group) in modern periodic table similarly if this applies to hydrogen's position then we find that the position of Hydrogen is wrong and properties are not matched with the alkali metals.while if it positioned in halogen family then the electronegativity of hydrogenMiss-matched with the periodic trend followed by group.[1]

SIMILARITIES WITH CARBON AND ITS FAMILY MEMBERS

Valence shell electron configuration- Hydrogen has only one electron in their valence shell but still it has half-filled valence shell electron configuration similar to carbon and its other family members also the electronegativity of carbon and hydrogen are quite similar i.e. 2.55 and 2.2 respectively. Hydrogen and carbon's relation can beunderstand by the focussing on

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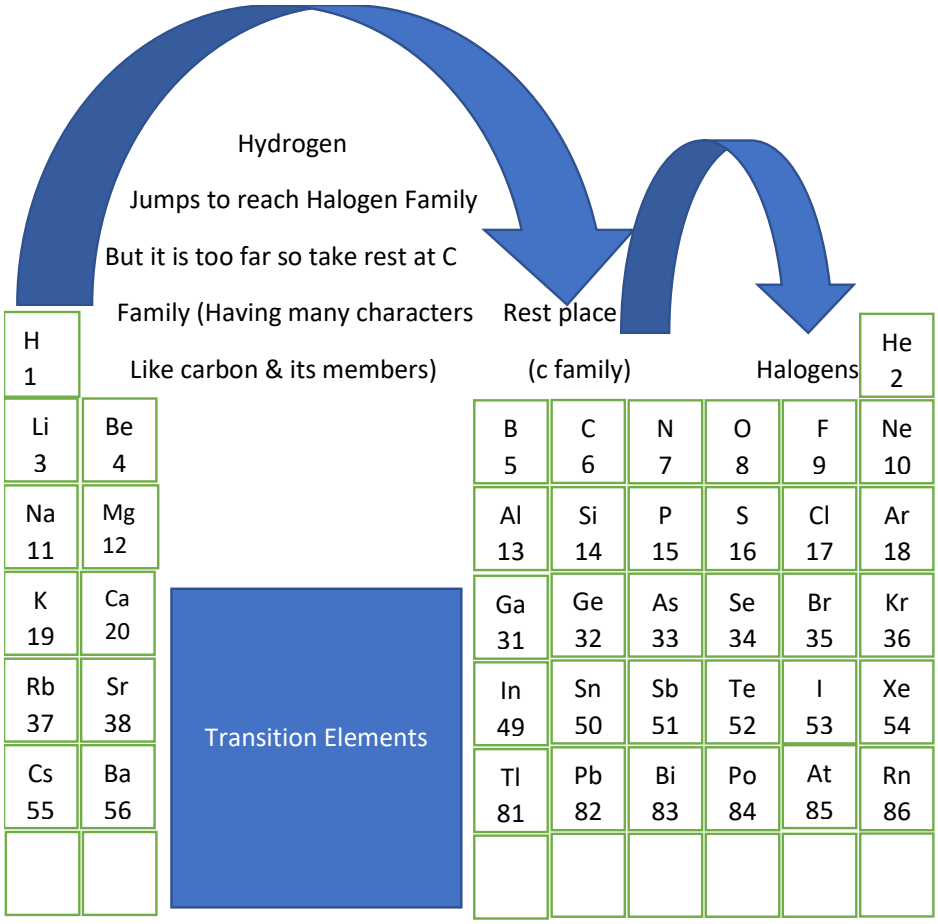
the comparison chemistry of H-H, C-H and Si-H bond formation as well as dissociation and by comparing the behaviour of their oxides.[2] It has been observed that hydrides and oxides of hydrogen are similar in their reactivity profile similar to that of hydrides of carbon. The study of chemistry of CH_4also allow to be seen the intrafamily nature of chemical bonding similar to those of NaK, ClF.

"Sillart and Hoffman" reveales in 1984 that great similarities between activation of the H-H bond dissociation in H_2 and C-H bond dissociation inCH_4 and also illustrated that family ties that bind hydrogen and carbon.[3] with this Ceyer in 2001 had supported this observation.[4]



If we compare the hydrides and oxides nature and behaviour of alkali metals, halogens and carbon family ultimately, we found more behavioural similarities of hydrogen with carbon and its family members regards to follow periodicity of periodic table.

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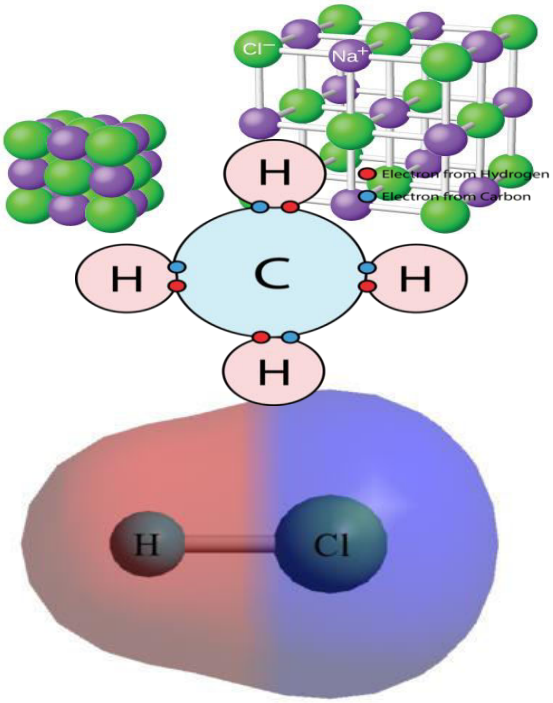
Comparative aspects of hydrides of hydrogen, Alkali metals, Halogens and Carbon family

Nature of bonding- Definitely from physical aspects of chemistry Hydrogen has identical atomic term i.e. $^2S_{1/2}$ to that of alkali metals but still alkali metals never form M^- ion like H^- which is stable hydride ion. All alkali metals form salt MX are ionic solids but HX compounds are covalent and gaseous in nature. Still electron cloud shifts towards halogen in HX due to the highly electronegative nature of Halogens.[5]



Polar bond between hydrogen and chloride atoms in hydrogen chloride

Fuel Efficiency of Hydrides of Carbon and Hydrogen: Hydrogen itself a hydride of hydrogen while hydrocarbons are hydrides of Carbon. both kinds of hydrides are good fuels that they have good fuel efficiency with high calorific value.

Hydrocarbons are the main source of the world' electric energy and heat sources (such as home heating) because of the energy produced when burnt. Often this energy is used directly as heat such as in house heaters, which use either petroleum or natural gas. The hydrocarbon is burnt and the heat is used to heat water, which is then circulated. A similar principle is used to create electric energy in power generator plants.[6]

Common properties of hydrocarbons are the facts that they produce steam, CO_2 and heat during Combustion and that O_2 is required for combustion to take place. The simplest hydrocarbon, CH_4, burns as follows:

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2 + \text{energy}$$

In inadequate supply of air, CO gas and H_2O are formed:

$$2CH_4 + 3O_2 \rightarrow 2\ CO + 4\ H_2O$$

Even, for any chain alkaneof n carbon atoms,

$$C_nH_{2n+2} + (3/2n + 1/2)\ O_2 \rightarrow (n + 1)\ H_2O + n\ CO_2 + \text{energy}.$$

Burning of hydrocarbons is an example of an exothermic chemical reaction.

Hydrocarbons can also be burned with elemental F_2,resulting
in CF_4 and HF products.

Hydrogen is one of the alternate fuel accordance with Energy Policy Act of 1992 Hydrogen. hydrogen as an alternative transportation fuel idea starts from its ability to power fuel cells in zero-emission FCEVs, its potential for native production as well as its fastsubstantial time,

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and the fuel cell's high effectiveness. Even a fuel cell coupled with an electric motor is two to three times more efficient than an internal combustion engine running on gasoline. Hydrogen can also assist as fuel for internal combustion engines.[7]

Bond dissociation energies – Covalent bond dissociation energies $D^{o}298$ (KJ Mol^{-1}) for the alkali metals are so weak, they give way to the metallic state Li-Li (110.21); Na-Na (73.08); K-K (54.63); Li-K (82.0); Na-K (65.99); Hydrogen and Carbon as compare to these form very strong co-valent bond H-H (435.99); H_3C-H (438.9) and H_3C-CH_3 (376).[12]

Comparative aspects of Oxides of hydrogen, Alkali metals, Halogens and Carbon family-

It has to be proven that peroxides and super-oxides of alkali metals act as oxidising agents because they react with water to form hydrogen oxide and oxygen easily. Their oxides are not itself flammable but readily reacts to form base while come in contact with water. Oxide of hydrogen (water) is neutral and having good fire extinguisher property similar to that of Carbon's oxide (carbon di oxide) which is good fire extinguisher. Structural dissimilarities are also there but behaviour of oxides of carbon and hydrogen is similar towards fire.[8] Still in another review Silicon's oxide isn't a Fire extinguisher but it doesn't catch fire[13] and considered to be as periodic trend that on moving down in this group fire extinguisher behaviour of oxides decreases since the metallic character increases.

Suitable Diagonal relationship of Hydrogen with Be/N/Ne:

Be is similar in many properties with Aluminium as first 20 elements of periodic table shows diagonal relationship. Hydrogen has no properties similar to that of beryllium as beryllium is metallic in character while Hydrogen is a Non-Metal.[9] If it positioned at Halogen family then it should be similar to that of Neon both are gases but still its reactivity profile doesn't match with Ne as it is Noble gas and inert in nature while hydrogen is very reactive and reduces substances. If it placed at above the carbon atom it resembles with the Nitrogen in many properties and can be considered as diagonal relationship in following mannersthat both are Non-metals i.e. H_2&N_2 , Both are diatomic gases, both can form oxides having general formula M_2O (H_2O & N_2O), even Hydrogen can form stable cation as well as anion Nitrogen also capable to form these both intermediate species, both elements have capacity to form hydrogen bonding.[10,11]

Results and discussion

Above discussion have many views to positioned Hydrogen atom in a suitable group Hydrogen have Properties similar to Alkali metals but Maximum properties are different also in Halogen relation of hydrogen is at greater extent while their non-metallic character, their covalent bond formation nature in many compounds with ionic bond formation nature but still their electronegativity in contras is not getting matched with hydrogen in periodic trend as Hydrogen is least electronegative in group.

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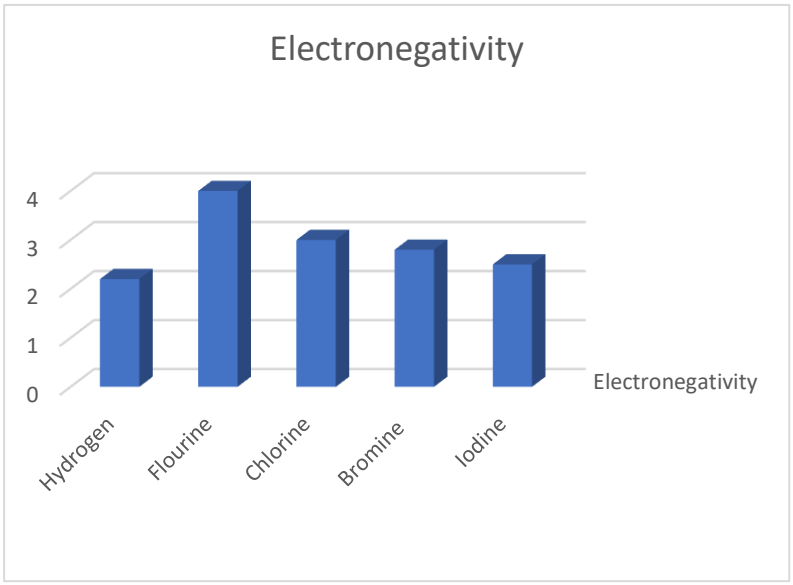
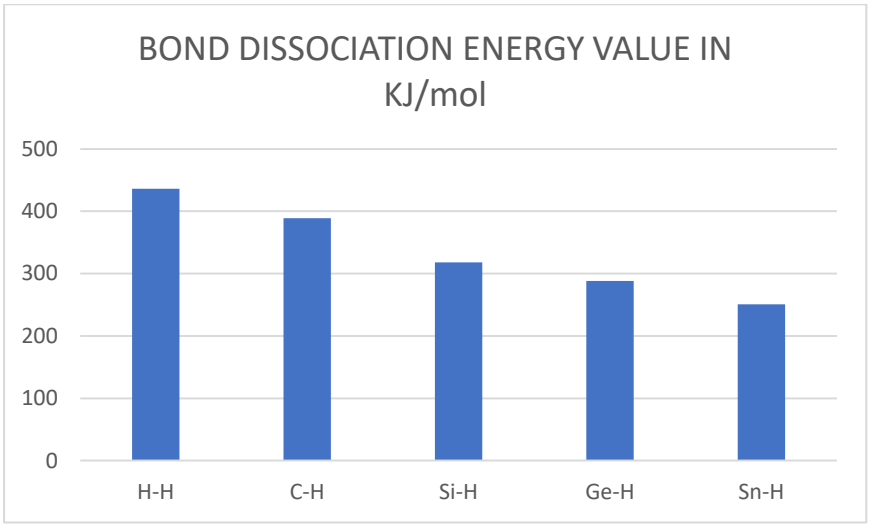


Similarly if Hydrogen positioned at group IV A i.e. carbon family then maximum properties are similar to that of Carbon like their half filled valence shell electronic configuration, their covalent bond formation nature, fuel efficiency of their hydrides, comparable bond dissociation energy values (C-H 389KJ/mol, H-H 436KJ/mol, Si-H 318KJ/mol, Ge-H 288 KJ/mol, Sn-H 251 KJ/mol) are accordance with periodic trend,



similar property of their oxides as fire extinguisher i.e. water and carbon dioxides silicon oxide itself doesn't catch fire but not having property of fire extinguisher, and diagonal relationship with nitrogen atom.

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Conclusion

Above evidence indicate that Hydrogen is a new group member of Carbon family. It belongs to all three groups of periodic table i.e. group I Alkali Metals, group IV i.e. Carbon Family and group VII A Halogen family but more conveniently with group IV carbon family. Hydrogen is not a fixed member of a particular group as it is Peripatetic of periodic table.

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