

# Hydrogen and its compound

H is first element

of periodic table

However its position is not fix in  
the periodic table

because it resemblance with alkali metal  
and halogen

Alkali metal =  $\overline{ns^1}$

halogen conf =  $\overline{ns^2 np^5}$

H =  $\overline{1s^1}$

Hydrogen has higher I.E than the alkali metal it more show

more resemblance with Halogen in terms of

I.P

$$\text{Li} = 520 \text{ KJ/mole}$$

$$\text{F} = 1680 \text{ KJ/mole}$$

$$\text{H} = 1312 \text{ KJ/mole}$$

like Halogen Hydrogen also form diatomic ( $H_2$ ) and react with elements and form large number of covalent compound.

$\Rightarrow$  H is less reactive in compare to Halogen

$\rightarrow$  Hydrogen form oxide Halide and sulphide  
like alkali metal.



size of  $H^+$

$$1.5 \times 10^{-3} \text{ pm}$$

it is very small size and it does not  
exist in free form

size of normal cation is 50pm to 200pm

Di hydrogen element is most abundant element  
in Universe [70% by mass]

Giant planets like Jupiter and Saturn  
principal element is Di hydrogen

due to lighter nature it is very low in earth  
(0.15%)

Ques Which of the following element  
form maximum number of compound

- ① C    ② O    ③ S ~~H~~

# Isotopes of hydrogen

	H <sup>1</sup>	H <sup>2</sup>	H <sup>3</sup>	12-33 years
P	D	T		
e = 1	(Heavy hydrogen)	(Radioactive) Half life	it emits $\beta^-$ particle	
P = 1	1	1	Conc. in earth crust	
$\eta = 0$	0	1	if T is $10^{18}$ atom per protium	
	(H D)	2		

Physical prop.

$$\text{R}_i \propto = 74.14 \quad 74.14$$

relative  
abundance

<sup>Some</sup> isotopes have ~~chemical prop~~ because they have  
<sup>Some e<sup>-</sup> conf.</sup> but they have diff rate of  
reaction due to their diff bond enthalpy

Type of H

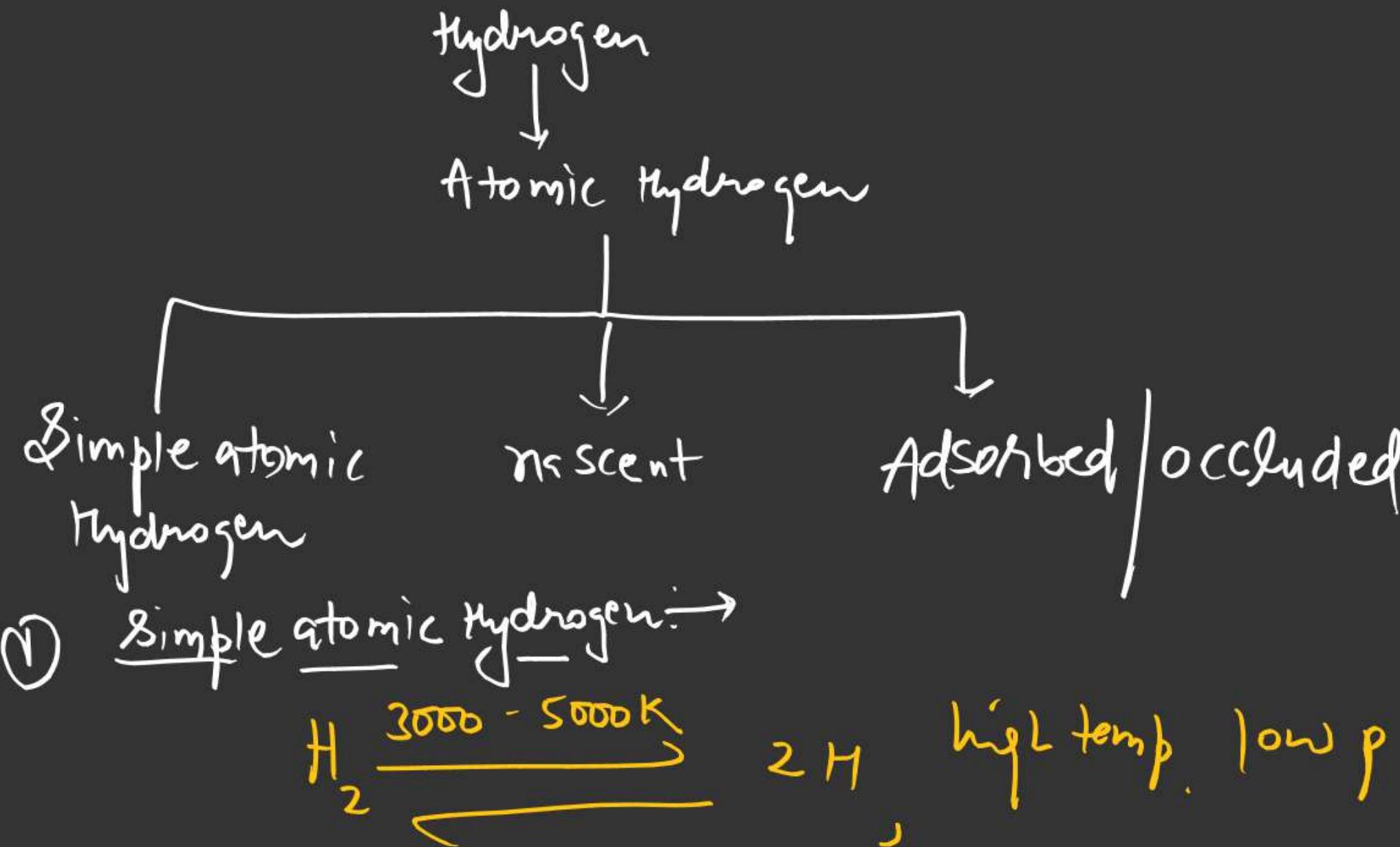
(i) based on oxidation



one In aq. solution hydrogen exists as



② based on reactivity



Nascent hydrogen  $\rightarrow$  during the reaction



## Adsorbed | Occluded Hydrogen

Occlusion :- The prop. of metal to adsorb any gas at surface is called occlusion.

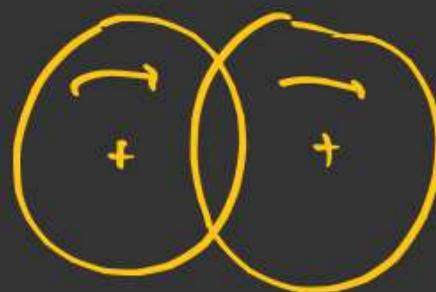
Order of reactivity

atomic hydrogen > nascent > molecular hydrogen



based on nuclear spin

① Ortho



The molecular form of hydrogen  
having same spin of nucleus

② Para



The molecular form of  
hydrogen Having diff  
spin of nucleus

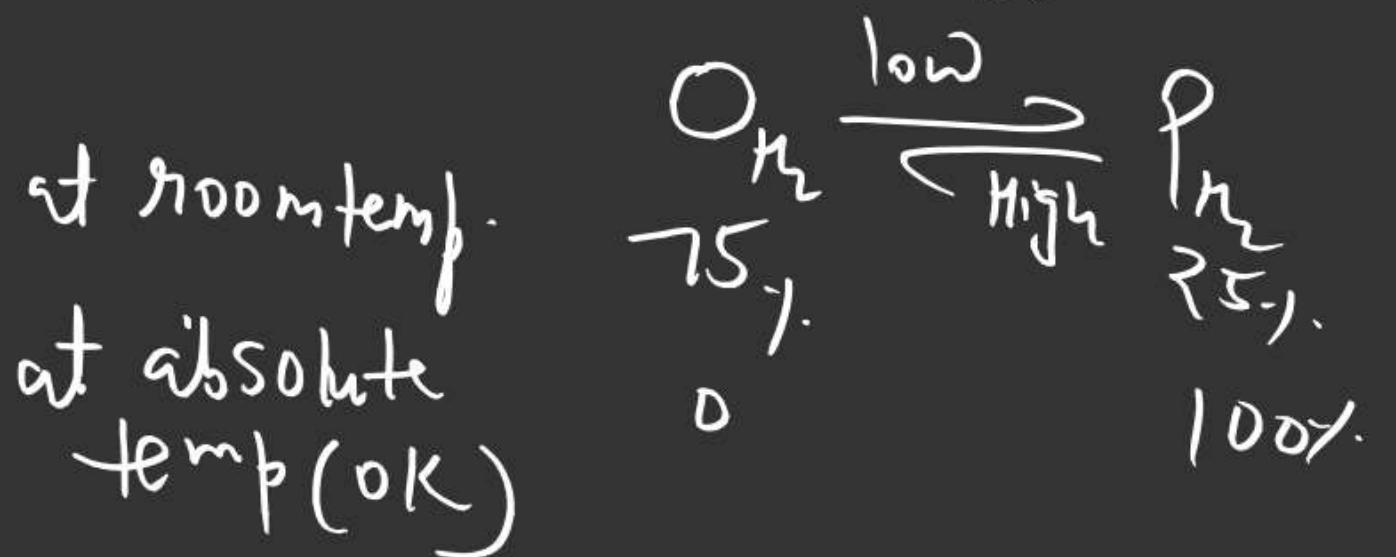
In ortho, spin of nucleus in same direction

So they will repel each other and the internal energy of ortho increases

Stability  $\Rightarrow$  Stability of ortho and para hydrogen

depends upon temp. at High temp.

ortho is more stable than para, and  
at low temp. para is more stable than  
ortho.



We can obtain 100% para from ortho at low temp. but we can not get 100% ortho from para at high temp. because at high temp. para decompose.