

## Dihydrogen (H<sub>2</sub>)

The most abundant element in the universe

70% of the total mass of the universe

0.15% by mass in the earth's atmosphere

## Isotopes of Hydrogen

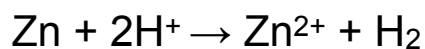
Protium -  ${}^1_1\text{H}$  (No neutrons)

Deuterium (Heavy hydrogen) -  ${}^2_1\text{H}$  (One neutron)

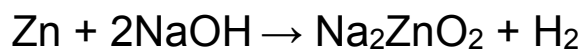
Tritium -  ${}^3_1\text{H}$  (Two neutrons)

## Laboratory Preparation of Dihydrogen

By the reaction of zinc with dilute hydrochloric acid



By the reaction of zinc with aqueous alkali



## Commercial Production of Dihydrogen

Electrolysing warm aqueous barium hydroxide solution between nickel electrodes

By electrolysis of brine solution

By the reaction of steam on hydrocarbons or coke at high temperatures

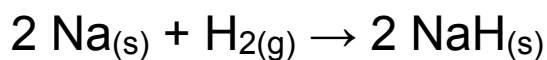
## Physical Properties of Dihydrogen

It is a colourless, odourless, tasteless and combustible gas

It is lighter than air and insoluble in water

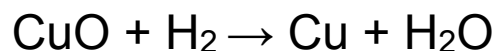
## Reaction of Dihydrogen with Sodium

Dihydrogen is reduced by sodium to form NaH



## Reaction of Dihydrogen with Copper(II) Oxide

Dihydrogen reduces copper(II) oxide to copper in the elemental state and itself gets oxidised to H<sub>2</sub>O



## Uses of Dihydrogen

Synthesis of ammonia

Manufacturing of vanaspati ghee by hydrogenation of vegetable oils

It is used to reduce heavy metal oxides to metals

Used in fuel cells and as a rocket fuel

## Structure of Water

Its shape is bent in the gaseous phase

Bond angle - 104.5°

O-H bond length - 95.7 pm

## Hard Water

Hardness is due to the presence of calcium and magnesium salts in the form of hydrogen carbonate, chloride and sulphate

