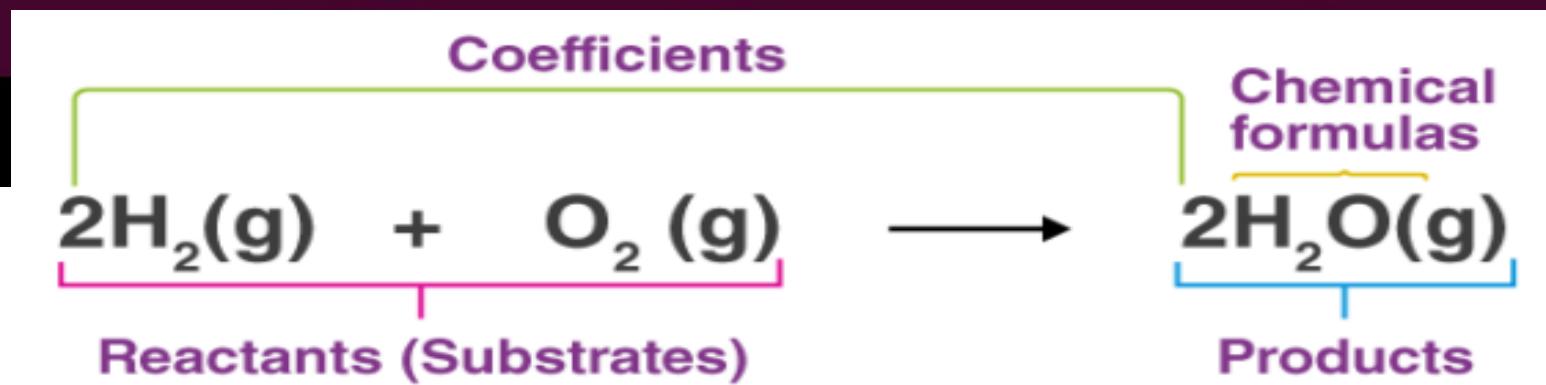
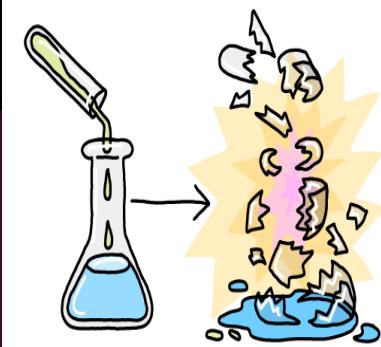


# Chemical Equations



**CHEMICAL  
REACTIONS**





From this picture,  
**ICE** melts into **WATER** and  
**WATER** turns into **ICE** also. This  
process  
make you reverse.

This change is **temporary**.

From this picture,  
**FIRE** will come **STICK**  
And you can not make this process is  
reverse.

This change is **permanent**.



Do you some more examples like this?



From this picture,  
After cutting the paper you seems  
a paper also.

So

**No new products will come this  
process**

**No new chemical properties occur  
after the process.**

From this picture,  
After chemical reaction of any  
materials disappear and  
**will come new products in this  
process**

**New chemical properties occur the  
new products.**



# So, we can make difference between the physical and chemical change



Melting



Boiling



Shredding

Physical change	Chemical change
Physical changes are mostly reversible.	Chemical changes are <u>not</u> reversible.
No new substances are formed.	One or more <u>new</u> substances are formed.
The substance <u>retain</u> its chemical properties.	the new substances formed have <u>different</u> properties from the original substance.



Chopping



Combustion



Digestion



Rusting



Rotting

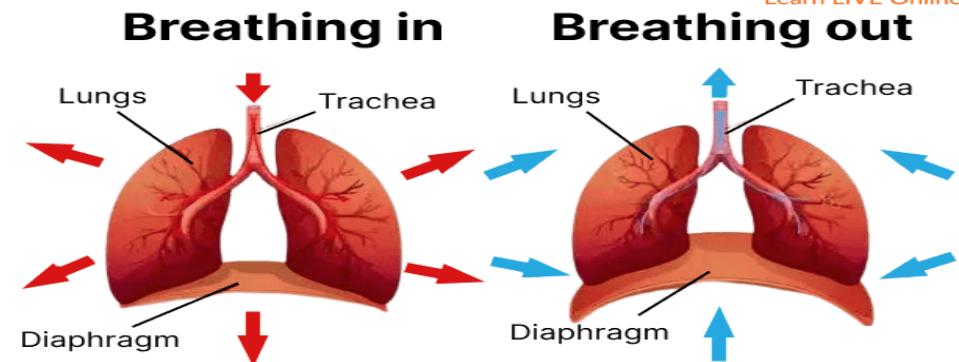
Tell me which are physical/chemical change above the

**Tick (✓) this mark appropriate answer according to the picture.?**



Burning of the crackers  
Physical / Chemical change

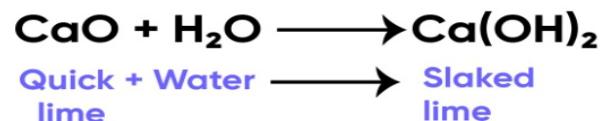
**Vedantu**  
Learn LIVE Online



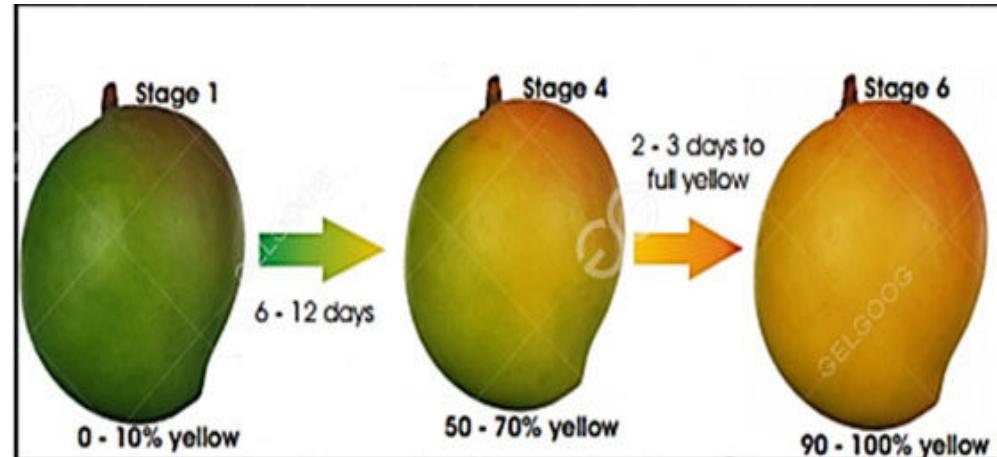
The process of Respiration  
Physical / Chemical change

### Reaction of Quick Lime with Water

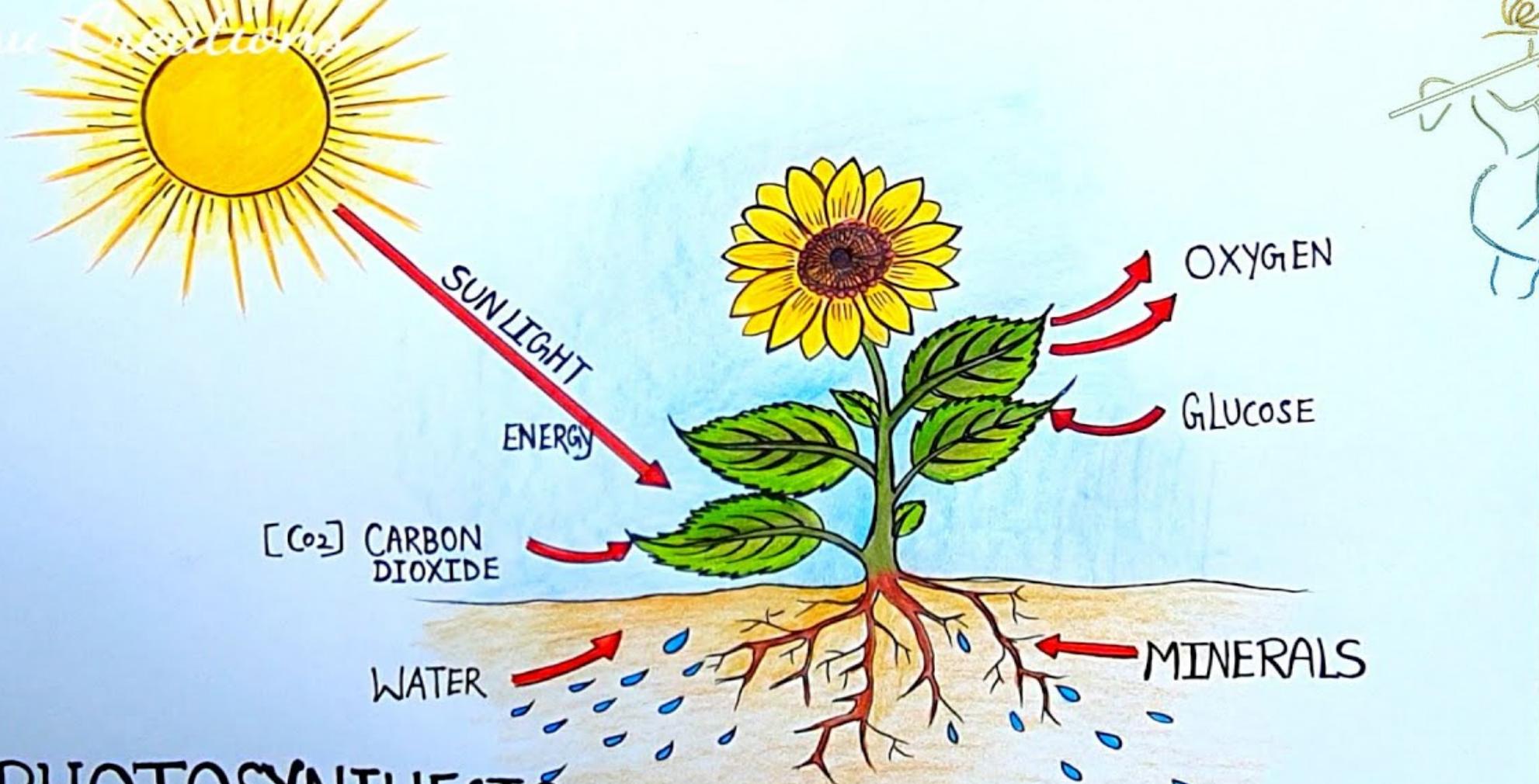
teachoo



Powdered lime added to water  
Physical / Chemical change



Ripening of the Mango  
Physical / Chemical change

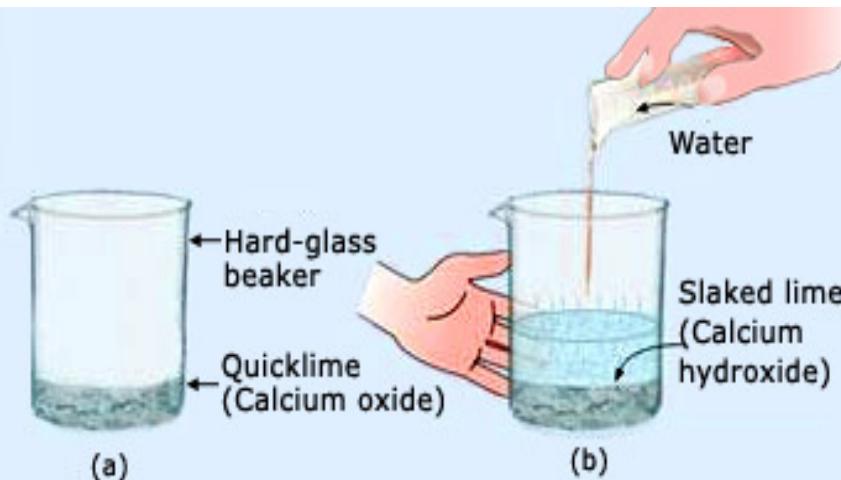


## PHOTOSYNTHESIS



This is physical or chemical change.?

## ACTIVITY 1



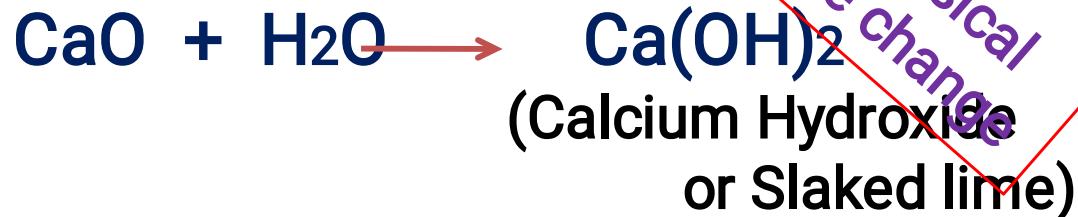
(a)

(b)

Quicklime reacts with water to form slaked lime releasing a lot of heat.

The beaker becomes hot. Its temperature rises.

### Quick lime /Calcium oxide ( CaO )



Heat & physical state change

This chemical reaction **liberates heat energy.**

A **red litmus paper turns into blue color** when it is dipped into  $\text{Ca(OH)}_2$

## ACTIVITY

Sodium sulphate =  $\text{Na}_2\text{SO}_4$

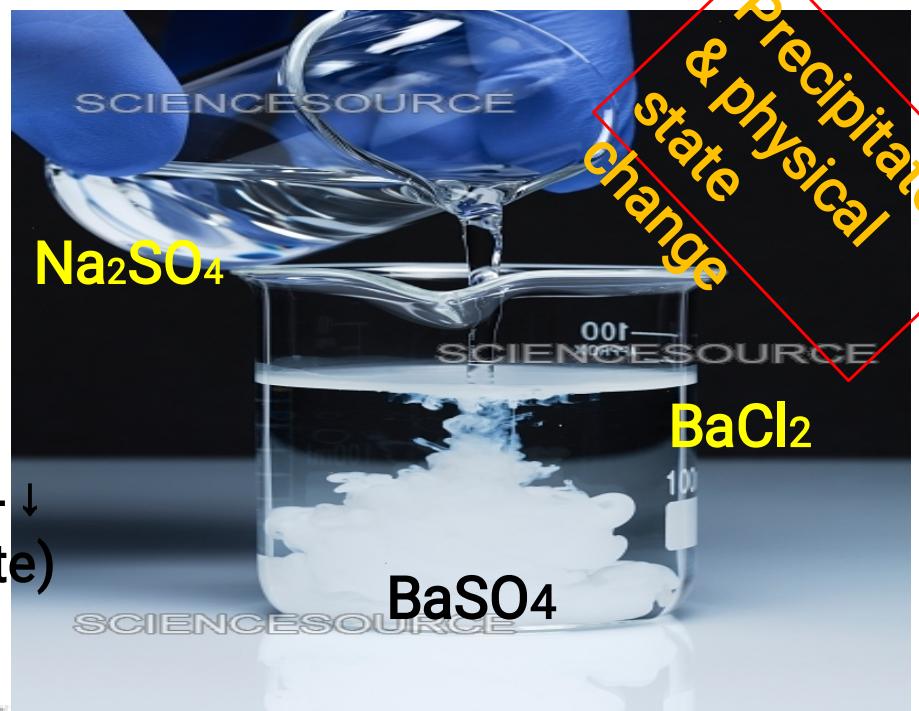
Barium chloride =  $\text{BaCl}_2$

Sodium chloride =  $\text{NaCl}$

Barium sulphate =  $\text{Ba}_2\text{SO}_4$



$\downarrow$  = precipitation

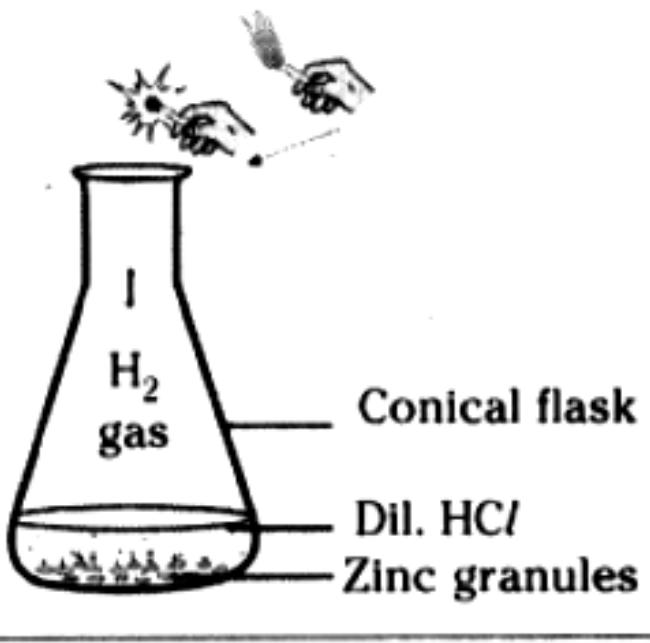


Precipitate & physical state change

$\text{BaCl}_2$

$\text{BaSO}_4$

## ACTIVITY 3



formation of H<sub>2</sub> gas by the action of dilute HCl on Zn and testing of H<sub>2</sub> gas

Take Zn granules in a conical flask.

Add dilute **hydrochloric acid (HCl)**



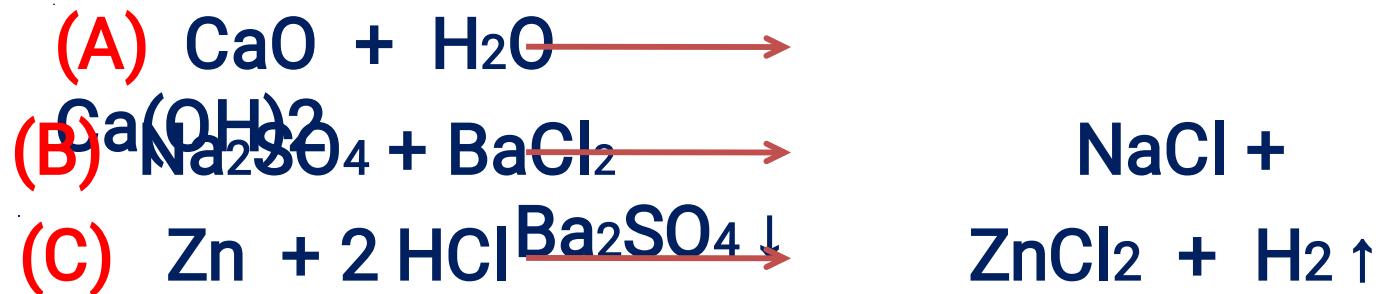
$\uparrow$  = liberate gas



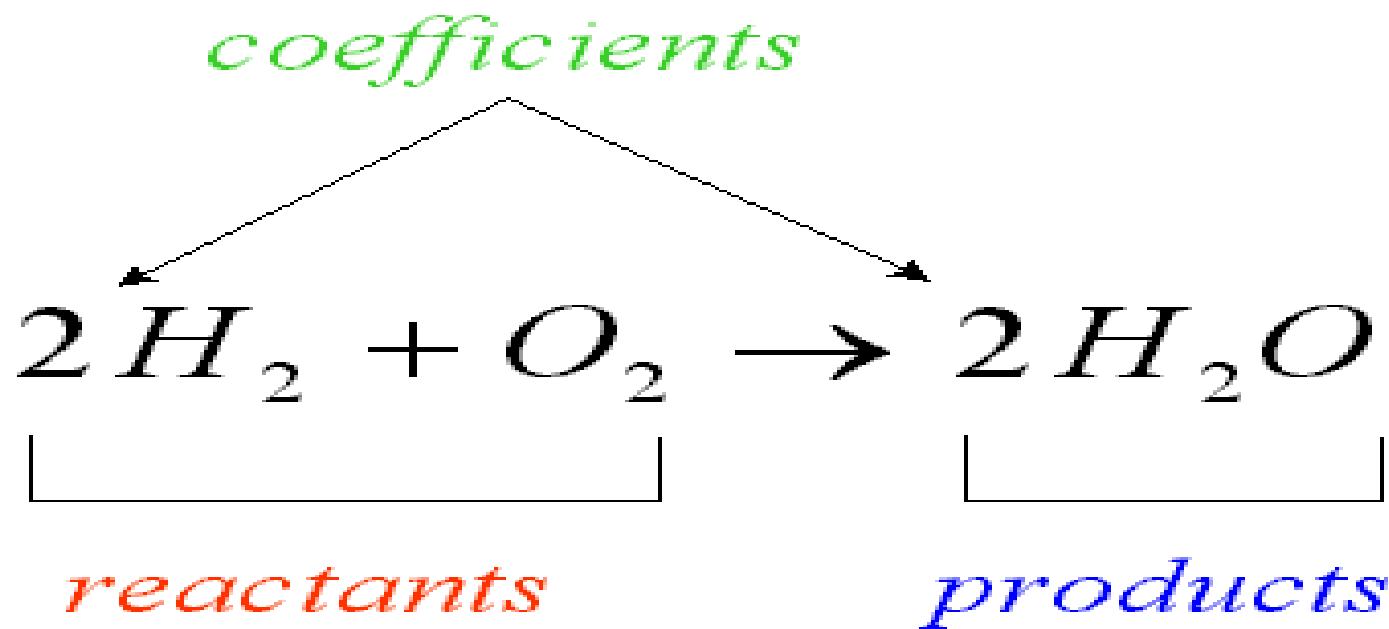
**Above all three activities tell us,** H<sub>2</sub> gas is put off the fire with pop sound always

1. Physical state change
2. heat changes ( exothermic or endothermic change)
3. gas evolved (if any)
4. precipitate formed(if any)

Liberate gas & physical state change



These are **CHEMICAL EQUATIONS.**



Do you say which are ***reactants*** and ***products*** also ***coefficients*** in above (A),(B) and (C) equations.?

# CHEMICAL EQUATIONS

WORD CHEMICAL EQUATION

SKELETON CHEMICAL EQUATION/CHEMICAL EQUATION

BALANCED CHEMICAL EQUATION

Hydrogen + Oxygen

(g) (g)

Water

(l)

Zink + Hydrochloric acid

(s) (aq)

Zink chloride + Hydrogen

WORD  
CHEMICAL EQUATION

H<sub>2</sub> + O<sub>2</sub>

(g) (g)

H<sub>2</sub>O

(l)

Zn + HCl

(s) (aq)

ZnCl<sub>2</sub> + H<sub>2</sub> ↑

CHEMICAL EQUATION

2H<sub>2</sub> + O<sub>2</sub>

(g) (g)

2H<sub>2</sub>O

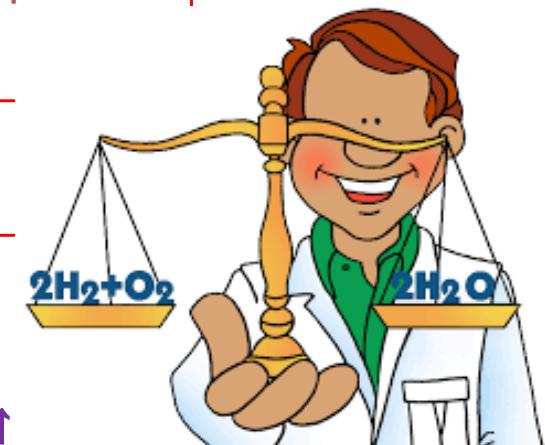
(l)

Zn + 2HCl

(s) (aq)

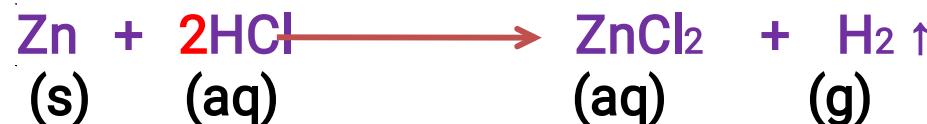
ZnCl<sub>2</sub> + H<sub>2</sub> ↑

(aq)



BALANCED  
CHEMICAL EQUATION

# What information do you get from a balanced chemical equation.?



A chemical equation should always be balanced according to **LAW OF CONSERVATION OF MASS**

1. Change of physical state.

2. Heat change (exothermic/endothermic change)

Heat is liberated is called **exothermic reaction**



Heat is absorbed is called **endothermic reaction**



3. Gas evolved (if any)

4. Precipitation formed (if any)

5. Balancing of reactants and products

6. Relationship of reactants and products.

i.e. mass and mass relationship (in U or gm)

mass and volume relationship (in U or gm to lit)

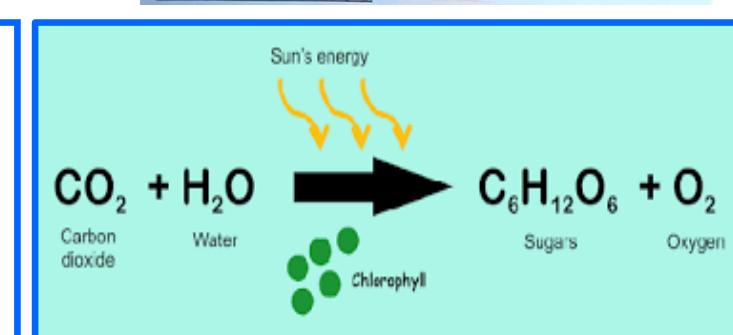
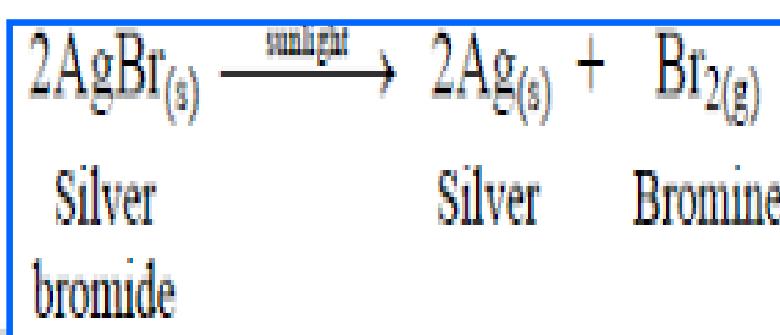
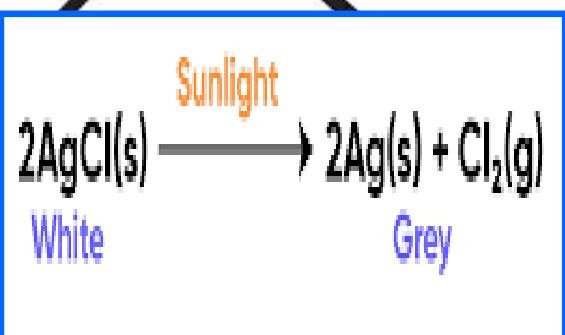
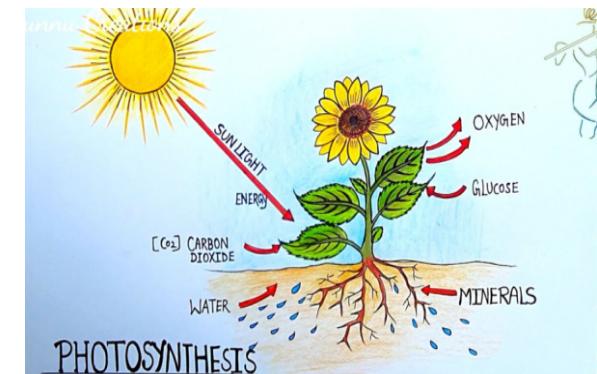
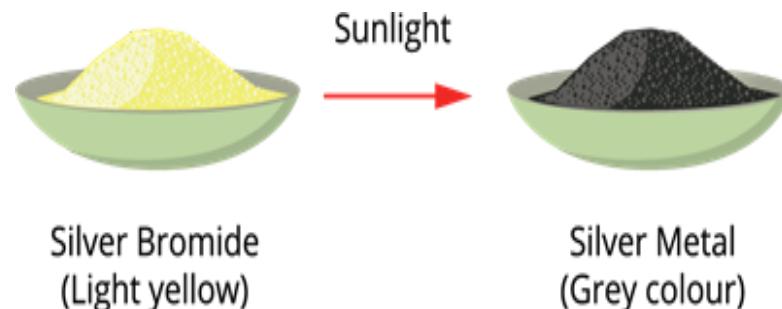
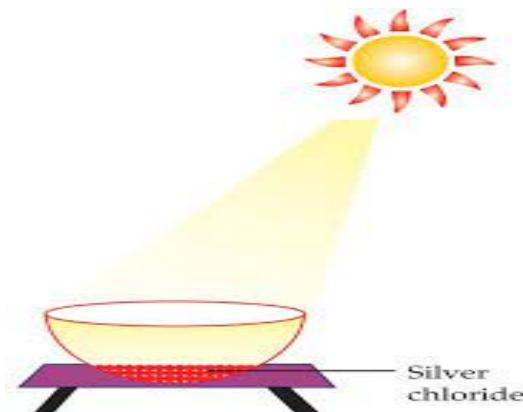
volume and volume relationship (in lit to lit)

mass, volume and number of molecules relationship ( $N_A$ )

7. Kind of chemical reaction (photochemical/electrolysis/precipitate)

# PHOTO CHEMICAL REACTION

The reaction which are by sunlight is called photo chemical reaction



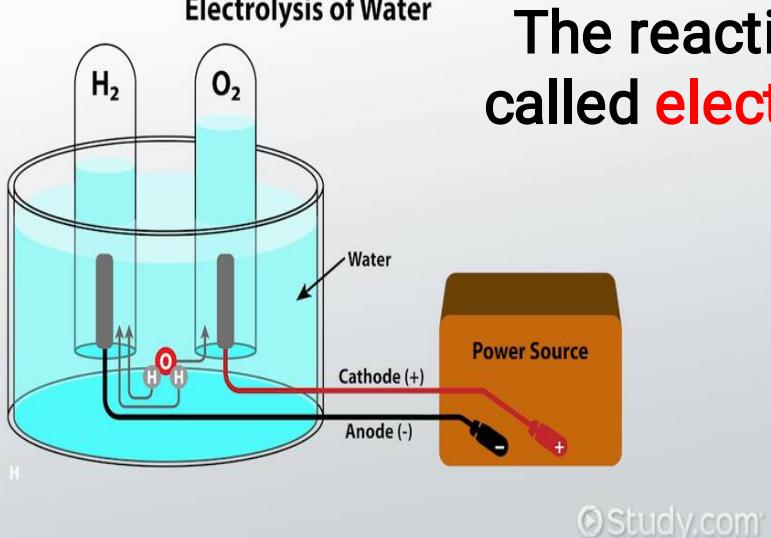
# ELECTROLYSIS REACTION

The reaction which are in presence of electricity is called **electrolysis reaction**

- Cathode reaction:



- Anode reaction:



# **EXOTHERMIC REACTIONS**



WATER AND ACID REACTION



NUCLEAR FISSION



CAMPFIRE



FREEZING WATER INTO ICE



RUSTING

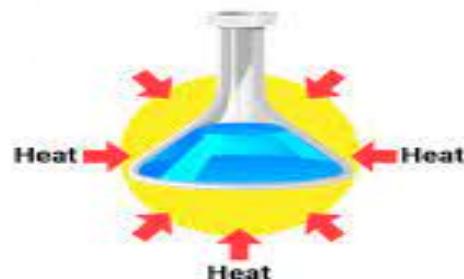
The reactions which heat liberated is called  
**EXOTHERMIC REACTIONS**

## **Exothermic**



## **ENDOTHERMIC REACTIONS**

### **Endothermic**



The reactions which are heat absorbed is called  
**ENDOTHERMIC REACTIONS**



DISSOLVING SALT IN WATER



PHOTOSYNTHESIS



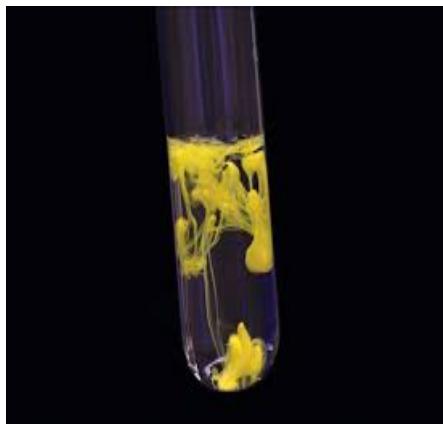
BAKING BREAD



COOKING AN EGG



WATER EVAPORATION

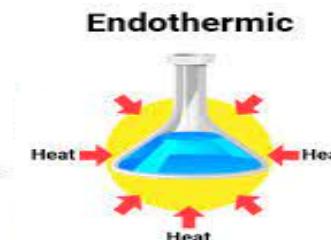
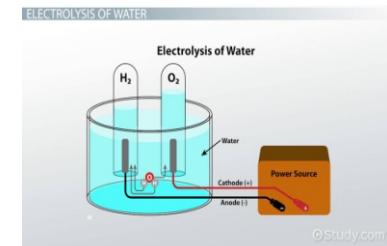


## SYRUP WITH PRECIPITATION

The reaction which are formed precipitate is called **PRECIPITATE REACTION**  
Overall we have five types of chemical reactions.

They are,

1. PHOTO CHEMICAL REACTIONS
2. ELECTROLYSIS REACTIONS
3. EXOTHERMIC REACTIONS
4. ENDOOTHERMIC REACTIONS
5. PRECIPITATE REACTION



# Balancing Chemical Equations

## STEPS TO BALANCE CHEMICAL EQUATION

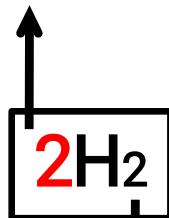
1. Write word equation
2. Write chemical equation ( skeleton equation ) with chemical formulae
3. Write number of atoms in reactants and products ( LHS and RHS ) separately
4. Do not touch the subscript of the molecules.
5. Assign suitable number in coefficient only and make balanced.

A chemical equation in which the number of atoms of different elements on the reactant side (LHS) are same as those on product side (RHS) is called **BALANCED CHEMICAL EQUATION**

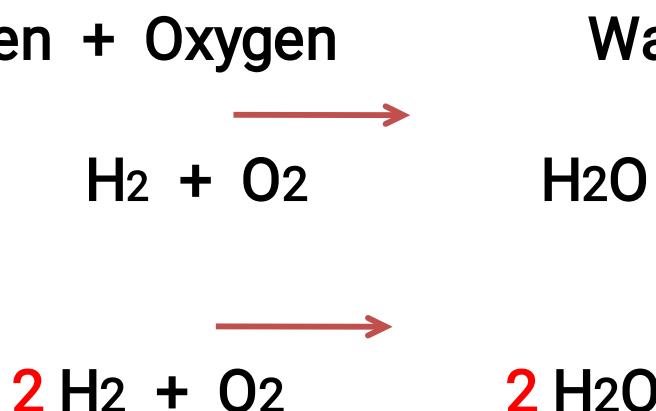
A chemical equation should always be balanced according to the **LAW OF CONSERVATION OF MASS**

Ex. coefficient.



  
2H<sub>2</sub>

subscript



ELEMENT	LHS	RHS
H	2	2
O	2	1
ELEMENT	LHS	RHS
H	4	4
O	2	2

Propane  $C_3H_8$ , the gas is often used as a heating and cooking fuel. It is burned in combustion and given the products are carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ).

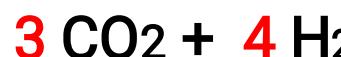
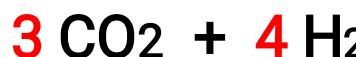
Ans: In this chemical reaction,

Reactants ( RHS) are  $C_3H_8$

$O_2$  ( combustion means in the presence of  $O_2$ )

Products (LHS) are  $CO_2$

$H_2O$



This is balanced chemical equation.

ELEMENTS	LHS	RHS
C	3	1
H	8	2
O	2	3
ELEMENTS	LHS	RHS
C	3	3
H	8	8
O	10	10

# Iron oxide reacts with Aluminum to form iron and Aluminum trioxide

Ans: Reactants are Iron oxide ( $\text{Fe}_2\text{O}_3$ )

Aluminum (Al)

Products are Iron (Fe)

Aluminum oxide ( $\text{Al}_2\text{O}_3$ )

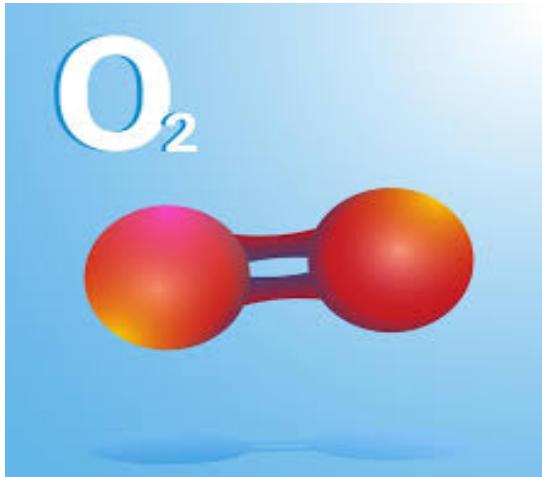
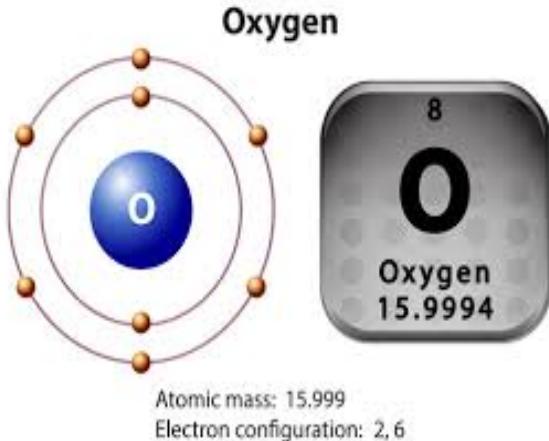


ELEMENT S	LHS	RHS
Fe	2	1
O	3	3
Al	1	
$\text{Fe}_2\text{O}_3 + \text{Al}$		$2 \text{ Fe} + \text{Al}_2\text{O}_3$



This is a balanced chemical equation.

ELEMENT S	LHS	RHS
Fe	2	2
O	3	3
Al	2	2

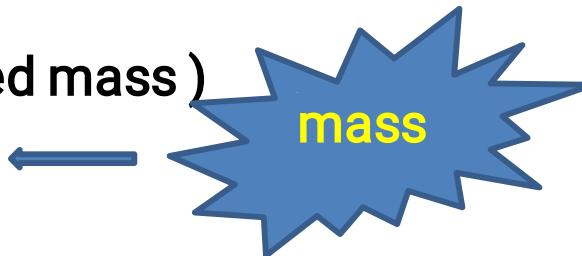


**OXYGEN (O)** is GAS an atom  
Atomic number is 8  
Atomic weight is 16 U

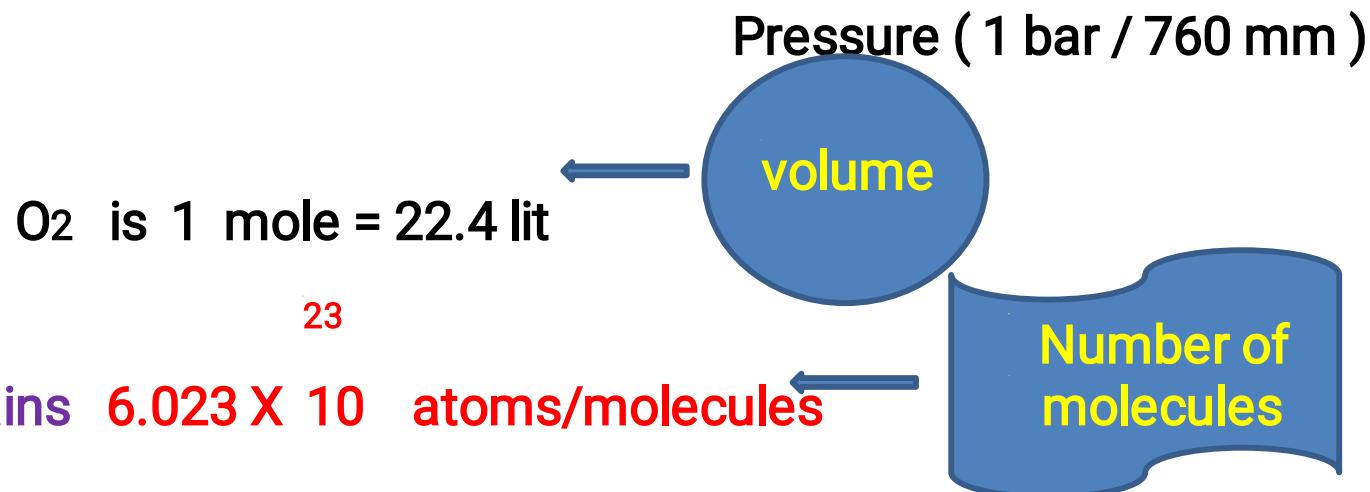
**O<sub>2</sub> (OXYGEN GAS)** is molecule  
Molecular weight is  $16 + 16 = 32$  U

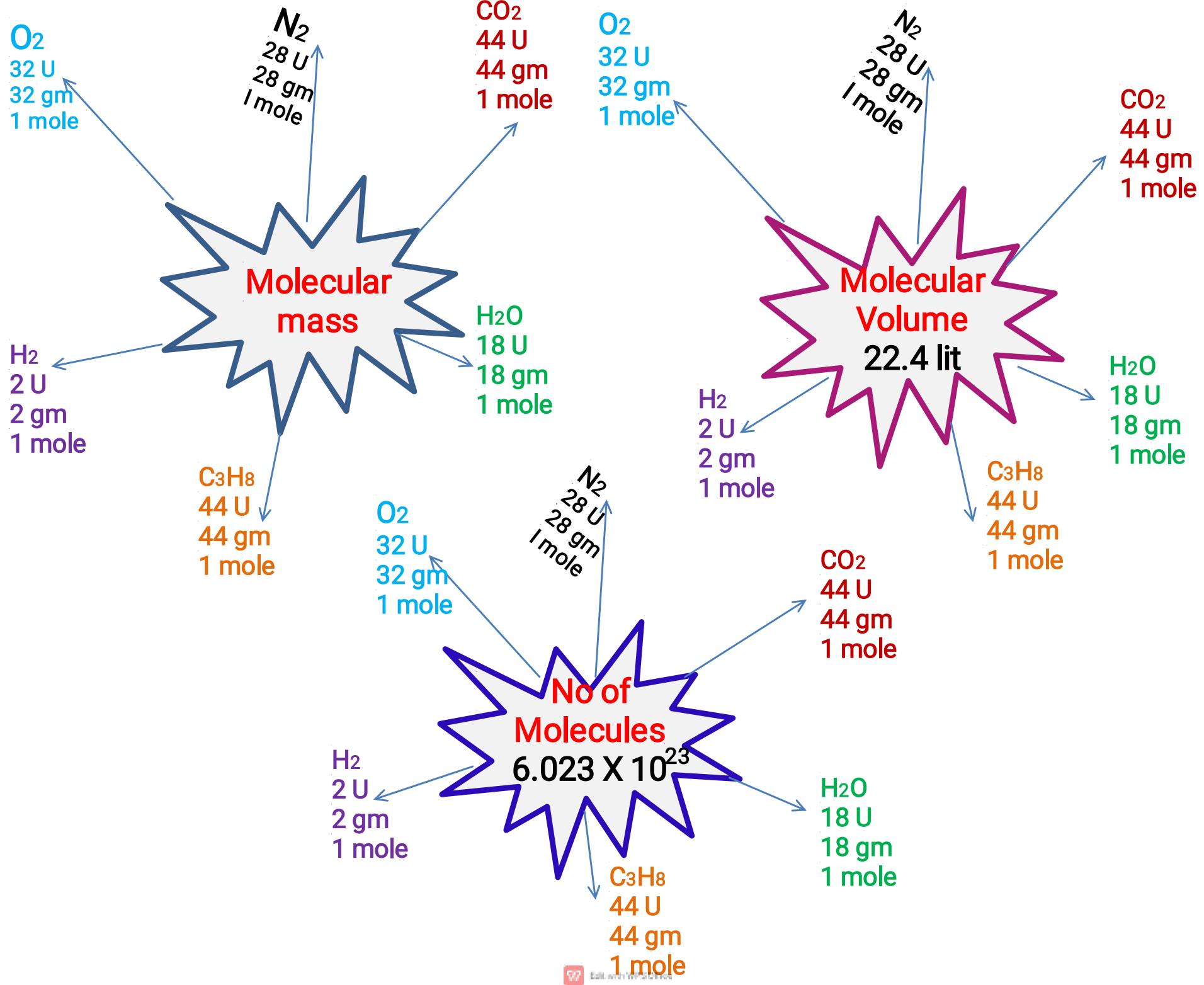
## OXYGEN (O<sub>2</sub>) GAS

Molecular Weight = 32 U (unified mass)  
= 32 gm



gram molar mass of gas occupied 22.4 lit at STP (Simple Temperature ( 0°C / 273 K) and





# TRY TO DO BALANCED EQUATIONS OF THE FOLLOWING

1.  $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
2.  $\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$
3.  $\text{Hg}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{HgI}_2 + \text{KNO}_3$
4.  $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{CO}_2$
5.  $\text{NH}_3 + \text{Cl}_2 \rightarrow \text{N}_2 + \text{NH}_4\text{Cl}$
6.  $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$
7. Calcium hydroxide (s) + Nitric acid (aq)  $\rightarrow$  Water (l)  
+ Calcium Nitrate (aq)
8. Magnesium (s) + Iodine (s)  $\rightarrow$  Magnesium Iodide (s)
9. Sodium Hydroxide reacts with Hydrochloric acid to form  
Sodium Chloride and Water
10. Barium Chloride reacts with liquid Sodium Sulphate to  
leave Barium Sulphate as precipitate and also form liquid  
Sodium Chloride.

(1).



(atomic masses of Al = 27 U, Fe = 56 U, and O = 16 U)

**calculate the amount of aluminum required to get 1120 kg of iron by the above reaction.?**

Ans : molecular weight of Al = 27 u ,  $\text{Fe}_2\text{O}_3 = 2*56 + 3*16 = 112 + 48 = 160$  u



First you balance the equation,



**Relation :**

$$54 * 1120 * 1000 = x * 112$$

$$x = 54 * 1120 * 1000 / 112$$

$$x = 54 * 10000$$

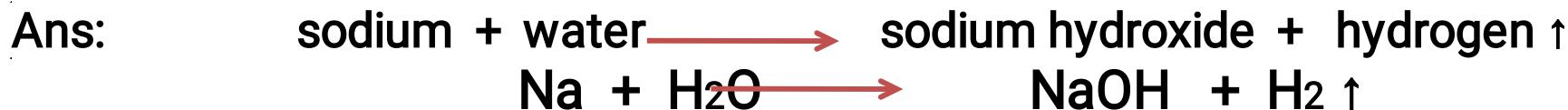
$$x = 540000 \text{ gm}$$

$$x = 540000 / 1000 \text{ kg} = 540 \text{ kg}$$



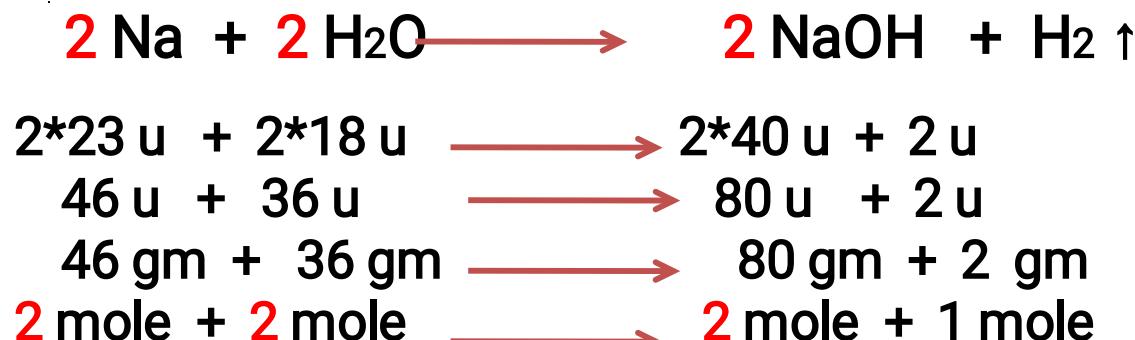
(2). Calculate the volume, mass and number of molecules of Hydrogen liberated when 230 gm of sodium reacts with excess of water at STP.

(Na = 23 u, O = 16 u, and H = 1 u)



molecular weight of Na = 23 u, H<sub>2</sub>O = 2\*1+16 = 18 u,  
NaOH = 1\*23+1\*16+1\*1 = 23+16+1=40 u, H<sub>2</sub> = 2\*1 = 2 u

first balanced the equation,



Now we calculate volume, mass and number of molecules from above info.

First we should calculate always mass of Hydrogen.

Relation between Hydrogen  $\longrightarrow$  sodium (according to question)

$$\begin{array}{ccc} 2 \text{ gm} & & 46 \text{ gm} \\ x & \cancel{\longrightarrow} & 230 \text{ gm} \end{array}$$

$$x * 46 = 2 * 230 \rightarrow x = 460 / 46 \rightarrow x = 10 \text{ gm}$$

Required Hydrogen mass = 10 gm

Now we calculate volume of Hydrogen.

According to balanced equation  $2 \text{ gm H}_2 = 1 \text{ mole}$

Occupied the volume of 1 mole gas = 22.4 lit

2 gm of  $\text{H}_2$  = 22.4 lit

10 gm  $\text{H}_2$  = x

$$\begin{array}{ccc} 2 \text{ gm} & & 10 \text{ gm} \\ & \searrow & \swarrow \\ 22.4 \text{ lit} & & x \end{array}$$

$$X * 2 = 10 * 22.4 \rightarrow x = 10 * 22.4 / 2 \rightarrow x = 5 * 22.4 \rightarrow x = 112 \text{ lit}$$

10 gm of  $\text{H}_2$  occupied the volume = 112 lit

At last we calculate number of molecules of Hydrogen

2 gm of  $\text{H}_2$  ( 1 mole ) =  $6.023 \times 10^{23}$

10 gm of  $\text{H}_2$  = x

$$\begin{array}{ccc} 2 \text{ gm} & & 10 \text{ gm} \\ & \searrow & \swarrow \\ 6.023 \times 10^{23} & & x \end{array}$$

$$X * 2 = 6.023 \times 10^{23} * 10 \rightarrow x = 6.023 \times 10^{23} * 10 / 2 \rightarrow x = 6.023 \times 10^{23} * 5$$

$x = 30.115 \times 10^{23}$  molecules

Number of molecules in 10 gm of  $\text{H}_2$  =  $30.115 \times 10^{23}$

## Questions time....???

1. What is molecular weight of  $\text{CO}_2$  ?
2. How much volume occupied of 1 mole  $\text{N}_2$  ?
3. 2 gm of  $\text{H}_2$  occupied 22.4 lit then how much volume of 20 gm of  $\text{H}_2$  occupied the volume.?
4. What is Avogadro Number( $N_A$ ) ?
5. What is STP?
6. Give two examples of physical change?
7. Give two examples of chemical change?
8. Balanced chemical equation has to be followed which law?
9. What information gives us the balanced chemical equation .?
10. Distinguish between exothermic and endothermic reactions?
11. Which gas is liberates that Zink reacts which acid.?
12. Write the photosynthesis reaction,?
13. How many molecules of  $\text{H}_2$  in  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
14. Water is formed by Hydrogen reacts with Oxygen.  
Calculate the mass of water and number of molecules of

1. Water is formed by Hydrogen reacts with Oxygen. Calculate the mass of water and number of molecules of water while we use 100 gm of hydrogen in this reaction.?

Ans :

Water forms that Hydrogen reacts with Oxygen



Now we know atomic weight of H=1 u and O= 16 u

then molecular weight of  $\text{H}_2 = 2 * 1 \text{ u} = 2 \text{ u}$

$$\text{O}_2 = 2 * 16 = 32 \text{ u}$$

$$2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$$

$$\begin{array}{ccc} 2 * 2 & \xrightarrow{\hspace{1cm}} & 2 * 18 \\ 4 \text{ u} & \xrightarrow{\hspace{1cm}} & 36 \text{ u} \\ 4 \text{ gm} & \xrightarrow{\hspace{1cm}} & 36 \text{ gm} \end{array}$$

Now calculate the mass of water

Relation



100 gm

x



$$x * 4 = 36 * 100 \rightarrow x = 36 * 100 / 4 \rightarrow x = 9 * 100 \rightarrow x = 900 \text{ gm}$$

Form the water mass = 900 gm

Now calculate the number molecules in water



$$1 \text{ mole} = 6.023 \times 10^{23} \text{ molecules}$$

From above info,

$$2 \text{ mole} = 2 * 6.023 \times 10^{23} \text{ molecules} = 12.046 \times 10^{23} \text{ molecules}$$

$$36 \text{ gm of Water} = 2 \text{ mole} = 12.046 \times 10^{23} \text{ molecules}$$

$$900 \text{ gm of Water} = x \text{ molecules}$$

$$\begin{array}{ccc} 36 \text{ gm} & & 12.046 \times 10^{23} \\ 900 \text{ gm} & \swarrow & \searrow \\ & x & \end{array}$$

$$x * 36 = 900 * 12.046 \times 10^{23} \rightarrow x = 900 * 12.046 \times 10^{23} / 36 \rightarrow x = 100 * 12.046 \times 10^{23} / 4$$

$$x = 25 * 12.046 \times 10^{23} \rightarrow x = 301.15 \times 10^{23} \text{ molecules}$$

900 gm of Water molecule =  $301.15 \times 10^{23}$  molecules