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chemical change :— A chemical change is a type of change where internal chemical composition changes and a new material with completely new properties and different composition is formed. Such change is irrewersible and permanent in nature.

eg. (i) Digestion of food along with cooking
(ii) Fermentation of grapes.
(iii) Burning of fuel.

chemical reactions :— The changes taking place around us, caused by chamical change are called chemical reactions.

Syptoms which confirm the occurance of chemical changes and further, chemical reaction:-

(i) change in temprature (The reaction between zinc & Hcl)
(ii) change in colour (The reaction between lead nitrate and potassium iodide)
(iii) change in state (" " " " " " " ")
(iv) Evolution of Gas (Electrolytic decomposition of water)

chemical equations :- chemical equations are short hand inpuresentations of all the chemical reactions taking place around us. The detailed description of any reaction can easily be presented this way.

chemical equations can be puresented in two different forms.

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Reactants :— In any chemical reaction, the substances that undergo any chemical change, are called reactants.

(i) **Word equation** :— When any chemical reaction is shortened and simplified in the form of a few words, the simplified formate of such chemical equation is called a word equation.

ex- Magnisium + oxygen ⟶ Magnisium oxide
(reactants) (products)

(ii) **chemical equation / formula equation** :— When chemical reactions are expressed in the form of chemical formulae of substances involved there in, this concise formate is called chemical equation

eg. $Mg + O_2 \longrightarrow 2MgO$
(reactants) (Products)

chemical equations can be written in two different format / ways.

(i) **Skeletal chemical equation** :— The chemical equation which doesn't follow the law of conservation of mass and therefore, retains different numbers of atoms of reactants and products, is called a skeletal / unbalanced chemical equation.

eg. - $H_2 + O_2 \longrightarrow H_2O$

(ii) **Balanced chemical equation** :— The chemical equation which is written by following the law of conservation of mass and which

Products :- The new substances formed after the occurance of any chemical reaction are called products. 03

retains equal no. of atoms in reactants as well as products, is called a balanced chemical equation.

eg.: $2Cu + O_2 \longrightarrow 2CuO$

$H_2 + O_2 \longrightarrow 2H_2O$

$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

Steps to balance a chemical equation :-

(i) A box / big bracket should be made at first around each reactant and product.

(ii) NO change can be done in the sub-scripts of any element or compound.

(iii) Further, counting and listing of different atoms of elements involved in the reaction is done.

(iv) Balancing of equation should be started with the element having largest number of atoms.

(v) Likewise further balancing of atoms of all other elements should be followed.

Note :- TO balance the number of atoms, we can not change the formulae of reactants or products. Alteration can only be done at the left side of any element/compound, with the help of hit and trial method.

A chemical reaction/equation can also be made more informative / useful by writing —

(1) Physical states of reactants/products such as (s) for solid, (l) for liquid (g) for Gas, ($\triangle$) for heat supplied, $\uparrow$ for vaporised gases, (aq) for solution of any material in water, atmospheric pressure and temprature required at arrow of ~~eh~~ equation.

The chemical formula of marbale - $CaCO_3$

Types of chemical reactions :-

(i) combination reaction :- The types of reactions in which two or more than two smaller elements or compounds combine together to form a large compound and produce heat are called combination reactions.

eg. $\underset{\text{quick lime}}{CaO(s)} + H_2O(l) \longrightarrow \underset{\text{slaked lime}}{Ca(OH)_2(aq)} + \text{Heat}$

In other words, when two or more reactants combine together to produce a large single product, such reaction is called combination reaction.

combination reactions are generally exothermic (Heat producing) in nature.

(i) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2 aq + \text{Heat}$

(ii) $Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

Generally the calcium hydroxide formed in reaction (i) is used for white-washing of walls.

The same white-washed $Ca(OH)_2$ reacts with environmental CO_2 to produce bright calcium carbonate ($CaCO_3$) which causes walls to appear bright after 2-3 day of white wash.

(iii) Burning of magnisium in air is also an example of combination reaction.

$2Mg + O_2 \longrightarrow 2MgO + \text{Heat}$

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When magnesium ribbon is to be burnt in air, it needs to be cleaned before burning because as we know that magnesium is a very reactive metal, when it is exposed to air, it reacts with it and a thin layer of magnesium oxide gets deposited at it. therefore to remove this layer, it is cleaned before burning

(iv) $C + O_2 \longrightarrow CO_2 + Heat$

(v) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

Exothermic reactions :— The type of reactions in which a large amount of heat is produced at the end of any chemical reaction, at product side are called exothermic reactions.

eg :-

(i) $C_6H_{12}O_6(aq) + 6O_2 \longrightarrow 6CO_2(aq) + 6H_2O(l) + Energy$

(ii) The decomposition of vegetable matter into com-post is also an exothermic reaction.

Decomposition reaction :— The reaction in which a large compound decompose or breaks into two or more than two products with the help of heat, light or electricity is called decomposition reaction.

eg :-(i) $2FeSO_4(s) \xrightarrow{\triangle} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

Ferrous sulphate — Ferric oxide

(ii) $CaCO_3(s) \xrightarrow{\triangle} CaO(s) + CO_2(g)$

quick lime

iii $2AgCl(s) \xrightarrow[\text{Sunlight}]{h\nu} 2Ag(s) + Cl_2(g)$

* The decomposition reactions are indothermic reactions.

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*Silver chloride after decomposition turns grey to form silver metal.

Depending upon the method of decomposition, the decomposition reactions are of three types.

(i) Thermal decomposition :— The type of decomposition reaction which is carried out by supplying heat from any external source of heat is called thermal decomposition reaction.

eg. (i) $CaCO_3(s) \xrightarrow[\Delta]{Heat} CaO(s) + CO_2(g)$

(ii) $2Pb(NO_3)_2(s) \longrightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

(ii) Electrolytic decomposition :— The type of decomposition reaction which is carried out by supplying electricity is called electrolytic decomposition.

$$2H_2O \xrightarrow{\text{electricity}} 2H_2 + O_2$$

In the above reaction, the amount of Hydrogen is ~~the~~ double the amount of oxygen.

(iii) Photolytic decomposition reaction :— The type of decomposition reaction which is carried out in presence of sunlight is called photolytic decomposition reaction.

eg. (i) $2AgCl \xrightarrow{Sunlight} 2Ag + Cl_2$

(ii) $2AgBr \xrightarrow{Sunlight} 2Ag + Br_2$

* Silver bromide is generally used in black and white photo-graphy because it leaves mark upon itself when exposed to sunlight and slowly decomposes into silver and chlorine.

* Brown colour of copper turns black when it oxidizes and forms CuO.

(iv) Endothermic reaction :— The reaction in which heat is supplied at the beginning of reaction to initiate it, is called endothermic reaction.

$$2AgCl \xrightarrow{\text{sunlight}} 2Ag + Cl_2$$

$$CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$$

(v) Displacement reaction :— The reaction in which a more reactive metal (element) displaces a less reactive metal from its compound and captures its position itself is called a displacement reaction.

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

$$Zn + FeSO_4 \longrightarrow ZnSO_4 + Fe$$

Reactivity of metals towards above reaction is as follows - $Zn > Fe > Pb > H > Cu > Ag$

$$2AgNO_3 + Cu \longrightarrow Cu(NO_3)_2 + 2Ag.$$

(vi) Double displacement reaction :— The reaction in which exchange of ions occurs between reactants is called double displacement reaction. In such reactions, generally an insoluble precipitate is formed.

eg. $Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$

(vii) Precipitate reaction :— The reaction in which an insoluble precipitate is always formed, is known as precipitate reaction.

eg. $Pb(NO_3)_2 + 2KI \longrightarrow \underbrace{PbI_2}_{\text{Yellow ppt.}} + KNO_3$

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Oxidation reaction :— The reaction in which either oxygen is added/gained or hydrogen is removed/lost, such reaction is called oxida-tion reaction.

eg- $2Cu + O_2 \longrightarrow 2CuO$

Here, oxygen is added into copper to form copper oxide.

$6HCl + 2Fe \longrightarrow 2FeCl_3 + 3H_2$

Here, Hydrogen is being removed from HCl to form hydrogen gas.

- Above both the cases are examples of oxida-tion reactions.

Reduction reaction :— The reaction in which either addition of hydrogen or removal of oxygen occurs, such reactions are called reduc-tion reactions:

$H_2 + CuCl_2 \longrightarrow 2HCl + Cu$

↑ addition of hydrogen (Reduction)

$CuO + H_2 \xrightarrow{Heat} Cu + H_2O$

Removal of oxygen (Reduction) ↑

Redox reaction :— The reaction in which oxida-tion as well as reduction (both) occurs simultaneo-usly, such reactions are called redox reacti-ons.

eg- (i) $ZnO + C \longrightarrow Zn + CO$

addition of oxygen (oxidation) ↑

Removal of oxygen (Reduction) ↑

(ii) $CuO + H_2 \xrightarrow{Heat} Cu + H_2O$

Redn. ↓

Oxidn. ↑

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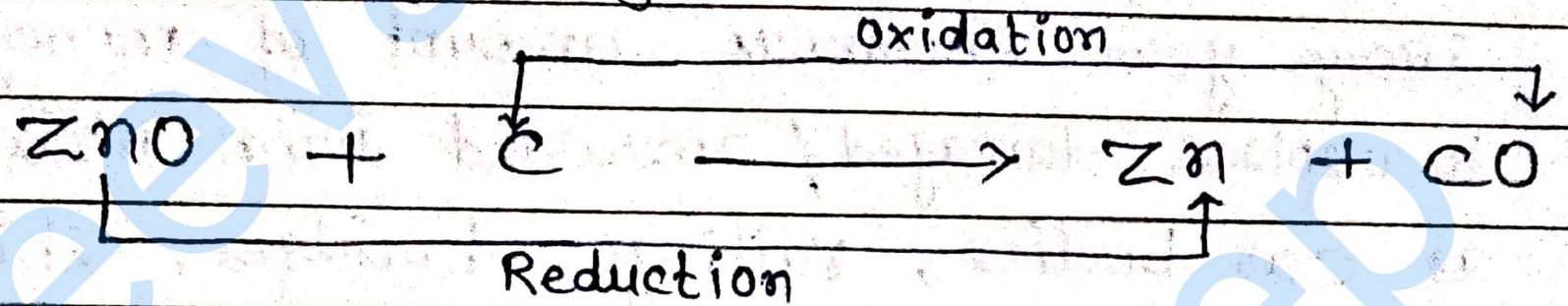
Oxidising agent :- The compounds or elements among reactants which helps in the process of oxidation either by supplying oxygen or by removing hydrogen in the reaction are called oxidising agent.

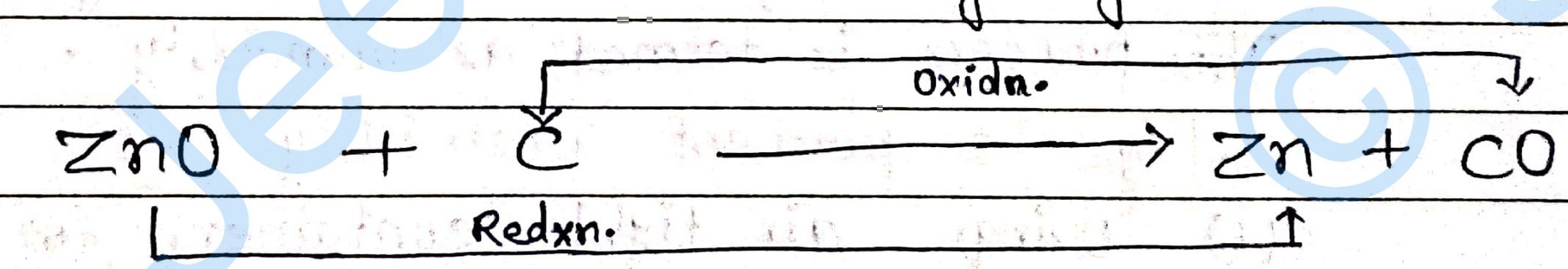
eg:-



In the above reaction, Zinc oxide (ZnO) is the reactant which supplies oxygen for oxidation of C-atom, therefore ZnO is here oxidising agent.

Reducing agent :- The compounds or elements among reactants which helps in the process of reduction either by supplying Hydrogen or by removing O-atom in the reaction, are called reducing agent.

eg:-



In the above reaction, C atom among reactants compels ZnO to remove/lose Oxygen and get converted into pure zinc metal (Zn). Therefore C-atom is reducing agent.

Corrosion :- When any metal is attacked by either by moisture or any acid and a thin layer of metalic oxide deposits over the metal, and the shiny appearance disappears and the layer of oxide gradually damages the quality of metal. Such process is termed as corrosion.

eg:-

$$4Fe + xH_2O + 3O_2 \longrightarrow 2Fe_2O_3 \cdot xH_2O$$

The corrosion of iron is given a special name "rusting"

Effects of corrosion :- corrosion causes damage to metalic materials by degrading their quality corrosion of iron is actualy a serious problem. Every year enormous amount of money is spent to replace damaged / corroded iron materials such as car bodies, railing, bridges, ships etc.

Ways to prevent corrosion :-

(i) By oiling
(ii) By applying grease
(iii) By electroplating
(iv) By painting
(v) By use of lubricants.

Rancidity :- When food materials are exposed to air for long, the fat and oil present in it get oxidized and develop a bad taste along with a foul smell. This process is termed as rancidity.

Ways to prevent rancidity :-

(i) Using air tight containers for preservation of food
(ii) Freezing
(iii) pasteurization
(iv) Using salt, sugar & vinegar etc. for prevention.
(v) Using antioxidants during preservation of food.
(vi) Flushing ready ready-made packs (tetra packs) of edibles with nitrogen gas

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Acids :- The substances which release H^+ ions or H_3O^+ (hydronium ions) in their aqueous solution, are generally called an acid. Eg. HCl, H_2SO_4 HNO_3, CH_3COOH, $\begin{matrix} COOH \\ | \\ COOH \end{matrix}$ etc.

Bases :- The substances which release OH^- ions (Hydroxide ions) in their aqueous solutions are known as bases. Eg. NaOH, KOH, $Ca(OH)_2$

Differences between an acid and a base :-

Acids	Bases
(i) Acids are sour in taste	(i) It is bitter in taste.
(ii) These are corrosive in nature.	(ii) These too are corrosive in nature.
(iii) Their aqueous solutions conduct electricity through them.	(iii) Their aqueous solutions don't conduct electricity through them.
(iv) These change blue litmus paper into red.	(iv) These change red litmus paper into blue.

Indicators :- The substances which indicate the differences between an acid and a base or any neutral material are called indicators.
Such indications can be indicated either by a change in colour or by a change in odour.
Based upon the method of indication, indicators can be classified into two categories.

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1. colour indicators :- Which indicate the differences by changing colours of materials. eg. turmeric, cabbage, china rose, litmus (obtained from lichen) etc.

2. Olfactory indicators :- The indicators which indicate the difference between any acid and any base by change of odour in different materials, are called ~~of~~ olfactory indicators. eg. Vanilla extract, raw onion, clove oil etc.

Universal indicators :- A universal indicator is a mixture of indicators which shows a gradual but well marked series of colour changes over a very wide range of changes in condentration of H^+ ions.

Indicator	Acids	Bases
1. Red litmus	No colour change	Blue
2. Blue litmus	Red	No colour change
3. Phenolphthalein	colourless	pink
4. Methyl Orange	Red	Yellow.

Types of acids :- On the basis of origin / source acids are of two types.

1. Mineral acids :- Acids prepared with the help of minerals present on earth's crust. eg. HCl, H_2SO_4, HNO_3 etc.

2. Organic acids - The acids obtained either from plants or animals. eg. lactic acids, oxalic acids, acetic acid etc.

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* On the basis of strength, acids are of two types.

1. Strong acids :- The acids which dissociate completely in their aqueous solution are called strong acids. eg. HCl, H_2SO_4, HNO_3 etc.

2. Weak acids :- The acids which dissociate partially in their aqueous solution, are called weak acids. eg. lactic acid, oxalic acid, acetic acid etc.

Reactions of acid with metals :- Acids react with metals to produce a metalic salt along with Hydrogen gas. Further, the presence of hydrogen gas is detected by bringing a burning match-stick near the container containing hydrogen gas and the gas burns with a pop sound. This test is also known as pop sound test.

Acid + Metal ⟶ Salt + Hydrogen.

$2HCl + Zn \longrightarrow ZnCl_2 + H_2$

Reaction of acids with metal carbonates and metal bicarbonates :-

Metal carbonates / bicarbonates + Acids ⟶ Salt + carbon di-oxide + water

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$

$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

* Lime water test :- The presence of CO_2 can be tested by passing the gas evolved during the reaction through a solution of lime water : if the solution turns milky, the presence of CO_2 gets confirmed.

$Ca(OH)_2 + CO_2 \longrightarrow \underbrace{CaCO_3}_{\text{Milky white precipitate.}} + H_2O$

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On passing excess CO_2 the following reaction takes place....

$$CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$$

The milky colour disappears.

Reaction of a base with metals :- A few of bases react with metals to produce salts and hydrogen gas.

$$Base + Metal \longrightarrow Salt + Hydrogen$$

Such reactions are not possible with all the metals.

Neutralisation reaction :- When any acid reacts with any base it produces salt and water. In this reaction both acid as well as base neutralise the effects of each other, therefore, the reaction is known as neutralisation reaction.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

Strong acid + Strong base	$\longrightarrow$ Neutral salt + Water
Weak acid + Weak base	$\longrightarrow$ Neutral salt + Water
Strong acid + Weak base	$\longrightarrow$ Acidic salt + Water
Weak acid + Strong base	$\longrightarrow$ Basic salt + Water.

Reaction of metal Oxides with acids :-

1. Metal oxide + Acid $\longrightarrow$ Salt + Water.

$$CuO + 2HCl \longrightarrow CuCl_2 + H_2O$$

Reaction of non-metalic Oxides with bases :-

Non-metalic oxides + Base $\longrightarrow$ Salt + Water

$$CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + Water\ (H_2O)$$

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p^H Scale :— p^H is a german symbolization where p^H stands for potenz (power) of hydrogen. A negative logarithm of hydrogen ion concentration is known as p^H.

$$p^H = -\log[H^+]$$

Based upon the p^H of materials a scale has been developed to measure the concentration of H^+ ions in the aqueous solutions of materials. This scale is known as p^H scale.

* According to the p^H scale, the lesser is the p^H value, the stronger is the acid and vice-versa.
* As the concentration of H^+ ions increases, the value of p^H decreases.

Dilution :— The process of mixing acid or base slowly in very small proportions into a large amount of water is called dilution.

* On dilution, the concentration of H^+/H_3O^+ ions decreases
* On dilution, p^H of any acidic solution increases and for basic solution, it decreases.

p^H for acidic solution < 7
p^H for basic solution > 7
" " Neutral " $= 7$

Significance of p^H in daily life :—

1. **p^H in our digestive system :—** As we know, Hcl helps in digestion of food. But in case of over-eating, excess acid produced in stomach causes acidity. To get rid of the problem, either milk of magnesia [$Mg(OH)_2$] or baking soda [$NaHCO_3$] are used, which neutralise the excess acid.

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2. Tooth Decay :— The plakes present inside the mouth, attached to teeth, convert sugar into acids and gradually, the p^H of mouth decreases. When p^H of mouth goes below 5.5, tooth decay starts. To prevent this basic toothpastes are used so that the effect of acid can be neutralized.

3. p^H of soil :— A soil with a specific range of p^H (near to 7) is required for proper growth of plants. The soil should neither be alkaline nor highly acidic.

Alkali :— The bases which are soluble in water are called alkali. NaOH, KOH etc.

Some important Salts :—

1. Common Salt :— Sources :—

(I) Through Sea Water → Table salt

(II) Through rocks → Rock salt

In pure form, NaCl (common salt) is a white crystaline solid but due to presence of impurities, it appears brown often.

2. Sodium Hydroxide (caustic Soda) NaOH :—

Preparation :— It is obtained by the electrolytic decomposition of a brine solution (NaCl + H_2O). This whole process is known as chlor-alkali process.

$$2NaCl + 2H_2O \longrightarrow 2NaOH + Cl_2 + H_2$$

At Anode - Cl_2 gas
" cathode - H_2 "
Near the cathode - NaOH (caustic soda)

Uses of the products of chlor-alkali process :-
NaOH is used in manufacturing of paper, soap, detergent and artificial fibres etc. It is also used in de-greasing of metals.

Bleaching powder :- [Calcium Oxychloride ($CaOCl_2$)] (Basic salt)

Preparation :- Bleaching powder is produced by the action of chlorine gas over dry slaked lime.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

Uses :- (i) In disinfecting drinking water.
(ii) For bleaching of cotton in the textile industry
(iii) " " " wood pulp " " paper "
(iv) As an oxidising agent inside the industry.

Baking Soda [Sodium bicarbonate ($NaHCO_3$)] :-

When brine reacts with carbon-di-oxide and ammonia, baking soda is produced. This process is known as Solvey process.

$$\underbrace{NaCl + H_2O}_{\text{Brine}} + \underbrace{CO_2}_{\substack{\text{carbon}\\ \text{di-oxide}}} + \underbrace{NH_3}_{\text{Ammonia}} \longrightarrow NaHCO_3 + NH_4Cl$$

Properties :- It is a white crystaline solid which decomposes after heating over 543K, and sodium carbonate, carbon-di-oxide and water are produced.

Use of baking soda :-
(i) In making of baking powder (Baking soda + tartaric acid)
(ii) for cooking soft and spongy food items.
(iii) As an ingredient of antacids.
(iv) In soda-fire extinguishers.

Washing Soda [Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$)]

Preparation :- Sodium carbonate can be recrystalised by dissolving it into water to produce washing soda.

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3 \cdot 10H_2O$$

Uses :— (i) As a cleaning agent at home.
(ii) For removing permanent hardness of water.
(iii) In glass, soap and paper industry.
(iv) In the production of other compounds.

Water of crystalisation :— Many salts contain water molecules inside them and are known as hydrated salts. The water molecule present in the salts is known as water of crystalisation.

Examples :— Blue vitriol - $CuSO_4 \cdot 5H_2O$
Gureen Vitriol - $FeSO_4 \cdot 7H_2O$
White Vitriol - $ZnSO_4 \cdot 7H_2O$

Plaster of paris :— calcium sulphate hemihydrate ($CaSO_4 \cdot \frac{1}{2}H_2O$)

Preparation :—
When gypsum ($CaSO_4 \cdot 2H_2O$) is heated at 373 K, it ~~reduces~~ loses water of crystalisation and converts into plaster of paris.

$$CaSO_4 \cdot 2H_2O \xrightarrow[373K]{\Delta(Heat)} CaSO_4 \cdot \frac{1}{2}H_2O$$

Properties :— When it is dissolved into water, it gets crystalised and forms gypsum.

$$CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \longrightarrow CaSO_4 \cdot 2H_2O$$

Uses :— For making toys, statues
" plastering bones
" making designs on walls and ceilings.

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Metals :- Metals are the elements having a tendency to form electro-positive ions by loosing their valance electrons. Eg. Iron (Fe), Aluminium (Al), Silver (Ag) copper (cu) etc.

Non-metals :- Non-metals are elements having a tendency to form electro-negative ions by gaining electrons in their valance orbit. Eg. Nitrogen (N) Sulphur(s), Oxygen (O) etc.

Physical properties of metals :-
(i) Metals are generally hard, malleable, lustrous, ductile, sonorous with high melting and boiling points. (ii) They are good conductor of heat and electricity.

Exceptions :- • Sodium is soft enough to be cut through a knife.
• Mercury is liquid at room temperature.
• Iodine inspite of being a non-metal. is lusturous.
• Diamond (an allotroph of carbon) is the hardest substance ever known so far.
• Bromine a non-metal is liquid at room temperature.
• Graphite (a non metal) is a good conductor of heat and electricity.

Chemical properties :-
1. Reaction with air (oxygen) :- Metals react with oxygen (air) to produce metalic oxides (basic).

$$2Cu + O_2 \longrightarrow 2CuO$$

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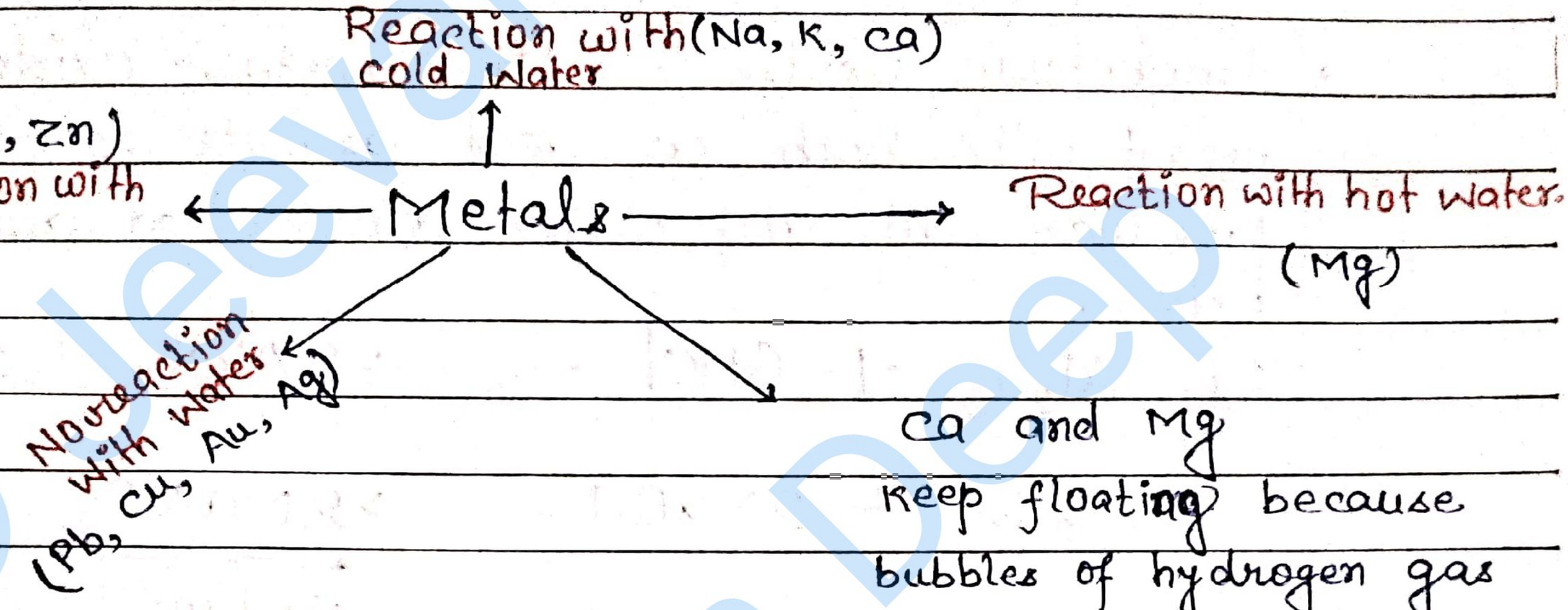
2. Reaction of metals with water :- Different metals react with water differently.



3. Reaction of metal oxides with water :- Metal oxides react with water to further produce hydroxide.

Metal Oxide + Water ⟶ Metal hydroxide.

$$CaO + H_2O \longrightarrow Ca(OH)_2 + Heat$$

4. Reaction of metals with acids :- Metals react with acids to produce metalic salt with hydrogen gas.

Metal + Dil. Acid ⟶ Metalic salt + H_2 gas ↑

$$Fe + H_2SO_4 \longrightarrow FeSO_4 + H_2$$

- When metals ~~don~~ react with nitric acid (HNO_3), these don't produce hydrogen gas because HNO_3 is a very strong oxydising agent. It reduces [O] atom produced to form water.

Some metals like magnesium and manganese ~~react~~ react with very dilute HNO_3 to produce Hydrogen gas.

$$Mg + 2HNO_3 \longrightarrow Mg(NO_3)_2 + H_2O$$

Metalic oxides are generally basic but a few metals form amphoteric Oxides.

- Amphoteric Oxides :— The metalic oxides which react with both an acid as well as a base to produce salt and water are called amphoteric oxides.

Eg. $Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$

$Al_2O_3 + 2NaOH \longrightarrow \underbrace{2NaAlO_2}_{\text{Sodium Aluminate}} + H_2O$

- Aqua Regia :— An acid prepared by a concentrated mixture of Hydro-chloric acid and nitric acid in 3:1 proportion, is called aqua Regia (Latin root meaning royal water). It can dissolve even gold and platinum.

Reaction of any metal with any salt solution of other metal :— In the above case, if the metal is highly reactive, displacement reaction occurs.

Metal X + Salt of metal Y $\longrightarrow$ Salt of metal X + Y

$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$

Reactivity Series :—

A series of elements arranged in a decreasing order of reactivity where the most reactive element is placed at the top, is called reactivity series.

The most reactive metals - K, Na
" least " " - Ag, Au

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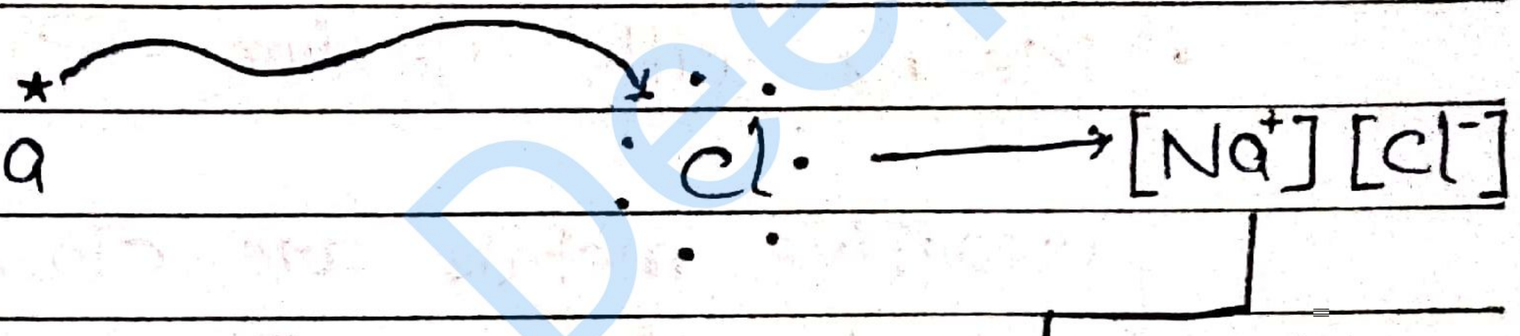
Ionic compounds :- The compounds formed by transfer of electrons from one species (element) to another, are called ionic or electro-valent compounds.

Formation of NaCl (ionic compound)

Na(11) - 2, 8, 1 Cl(17) - 2, 8, 7



Properties of ionic compounds

↳ • Ionic compounds are crystaline solid hard material.
• These have high melting and boiling points.
• These are good conductor of heat and electricity. (only in molten or aqueous solution)

Minerals :- The elements or compounds which are found naturally on the earth's crust are called minerals.

Ores :- Minerals in which high proportion of metals or non-metals can be extracted profitably / found are called ores.

Gangue :- The large amount of impurities which are present in ores are called gangue.

Metals with high reactivity :- K, Na, Ca, Mg, Al
" " moderate " :- Zn, Fe, Pb, Cu, Hg
" " least " :- Ag, Au

- Roasting :- The process of heating ores in presence of air (oxyen) in ample amount.
- calcination :- Heating ores in Limited supply of air

Metals with low reactivity :- Metals with low reactivity are generally sulphide ores which go through roasting accompained by oxidation further.

$$2CuS + 3O_2 \xrightarrow[\Delta]{Heat} 2Cu_2O + 2SO_2$$

$$2Cu_2O + 3CuS \xrightarrow[\Delta]{Heat} 6Cu + SO_2$$

- Metals with Medium Reactivity :-

Moderately reactive metals are classified in two categories.

- carbonates :- These ores are firstly calcinated and once these are converted into oxides, these are reduced to obtain pure metals.
- Sulphide ores :- These ores are roasted firstly and then oxides of ores are reduced to obtain pure metals.

- Metals with high reactivity :- Direct electrolytic decomposition of these ore are done to produce pure metals.

Refining of metals :- Electro-Lytic refining is done through electro-lysis. In this process the impure metal is made the anode and further a thin strip of pure metal is made the cathod. A solution of the metals salt is used as an electrotyte.

Alloy :- A homogeneous mixture of two or more metals.

Steel :- Iron + Carbon	Brass — copper + Zinc
Bronze :- copper + tin	Soilder - lead + tin

Amalgum. of metals. When any of them is "Hg