A. METALS

Those elements which form ions by losing electrons are called metals.

Physical Properties of Metals

Metals are malleable that is metal beaten into thin sheets

Malleability: The property which allows the metal to be hammered into thin sheets.It is important characteristic of metal.
Eg: Gold and silver metals are best malleable metals.
Eg: Aluminium and Copper metal are also highly malleable metals.
Aluminium Foils are used for decorating sweets and for packing food items like biscuit, namkeens etc.

Metals are good conductor of Heat

- Metal allows heat to pass through them easily.
- Silver metal is the best conductor of heat.It has highest conductivity.
- Copper and aluminium metal are also very good conductors of heat.
- The cooking utensil and water boilers are usually made of copper or aluminium because they are good conductors of heat.
- Poorest conductor of heat- Lead and Mercury

Metals are good conductor of Electricity

- Metal allows electricity to pass through them easily.
- Silver metal is the best conductor of electricity.

Metals have high meting and boiling point

- Iron metal has high melting point of 1535°C, this means that solid iron melts and turns into liquid on heating to a high temp.
- Copper metal has high melting point of 1083°C.

Exceptions:

- Sodium and potassium metal has Low melting point of 98°C and 64°C.
- Gallium and cesium metal also has low melting point 30°C and 28°C.

Metals are solid at room temperature

- Metals like iron, copper , silver, gold etc are solids at room temperature.
- Only one metal, i.e. Mercury is in liquid state at room temperature.

Metals are Sonorous

- Sonorous means capable of producing a deep or ringing sound.
- Metals make sound when hit an object.
- The property of metals of being sonorous is called sonority.
- It is due to the property of sonorousness that metals are used for making bells and strings of musical instrument like sitar and violin.

Metals are Strong

- Metal can hold large weight without snapping (without breaking) .
- Iron Metal used in construction of bridges buildings and railway line.
- Exception- sodium and potassium metal are not strong enough.

Metals are Ductile

- Ductility- The property which allows the metal to be drawn into thin wire
- Gold is the most ductile metal and silver are among the best ductile metal.
- Copper and aluminium metals are very ductile and drawn into thin copper and Aluminium wires.
- Magnesium metals are used in experiment in the laboratory and Tungsten metal are used for making the Filament of electric bulb.

Chemical Properties of Metals

Reaction of Metals with Oxygen

(metal + oxygen → metal oxide)

- $4Na(s) + O2(g) \rightarrow 2Na2O(s)$
  sodium oxygen sodium oxide
- $4\ Al(s) + 3\ O2(g) \rightarrow 2Al2O3(s)$
  (Aluminium oxide)
- $2\ Cu\ (s) + O2\ (g) \rightarrow 2\ CuO\ (s)$
  (copper oxide)
- $Zn(s) + 2HCl \dashrightarrow ZnO$
  Zinc Oxide
- $3Fe(s) + 2O2(g) \dashrightarrow Fe3O4(s)$
  Iron(II, III) oxide

L.P. : Why Potassium and sodium metal are stored under Kerosene oil?

The potassium and sodium metal are so reactive that they react vigorously with Oxygen (of air).

• They catch fire and start burning when kept in air.

So, it is kept in Kerosene to prevent their reaction with the O2 moisture and CO2 of air.

Kuch Kaam Ki Baat (K^3B) :

Upar Vali Reactions me hume product Metal Oxides mile, to chalo thoda metal oxides ke baare me padh lete hai ;)

REACTIONS OF METAL OXIDES

1. Most of the metal oxides are insoluble in water. But some of the metal oxides dissolve in water to form alkalis.

- Sodium oxide 16 a basic oxide which react with water to form an alkali called sodium hydroxide.

  $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$

  Due to formation of NaOH alkali, a solution of sodium oxide in water turns red litmus to blue
- Potassium oxide is also a basic oxide which reacts with water to form an alkali called potassium hydroxide.

  $K_2O(s) + H_2O(l) \rightarrow 2KOH(aq)$ {Turns red litmus to blue}

2. Those metal oxides which shows basic as well as acidic behaviour are called Amphoteric oxide. Aluminium metal and Zinc metal form amphoteric oxide, aluminium oxide and zine oxide are amphoteric in nature.

- Aluminium oxide reacts with Hydrochloric acid to form aluminium chloride and water.

  $Al_2O_3(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2O(l)$

  In this reaction aluminium oxide behave as basic oxide
- Aluminium oxide reacts with sodium hydrate to form sodium aluminate (salt) and water.

  $Al_2O_3(s) + 2NaOH(aq) \rightarrow 2NaAlO_2(aq) + H_2O(l)$

  In this reaction aluminium oxide behave as acidic oxide

3. Zinc Oxides Reactions:

- Zinc Oxides reacts with hydrochloric acid to form zinc chloride and water.

  $ZnO(s) + HCl \rightarrow ZnCl_2 + H_2O$

  In this reaction, zinc oxide behaves as basic oxide.
- Zinc Oxides reacts with sodium hydroxide to form sodium zincate and water.

  $ZnO(s) + HCl \rightarrow ZnCl_2 + H_2O$

  In this reaction, zinc oxide behaves as acidic oxide.

Reaction of Metals with Water

(metal + oxygen → metal hydroxide + hydrogen)

Metals react with water and produce a metal oxide and hydrogen gas metal oxides that are soluble in water dissolve in it to further form metal hydroxide

➢ For Na and K reaction is violent even with cold water and so exothermic that hydrogen immediately fire.

$$2\ Na + 2H_2O \rightarrow 2NaOH + H_2 + Heat$$

$$2\ K + 2\ H_2O \rightarrow 2KOH + H_2 + heat$$

➢ For Ca , reaction is less violent for hydrogen to catch fire

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$$

➢ Al , Fe don't form hydroxide as their oxides are not soluble.They do not react with the hot water but with steam.

$$2\ Al\ (s) + 3H_2O\ (g) \rightarrow Al_2O_3\ (s) + 3H_2(g)$$

$$3\ Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)$$

NCERT ACTIVITY

(AASAN BHASHA MEI)

Reaction of metals with Steam

Activity 3.10

CAUTION: This Activity needs the teacher's assistance.

- Collect the samples of the same metals as in Activity 3.9.
- Put small pieces of the samples separately in beakers half-filled with cold water.
- Which metals reacted with cold water? Arrange them in the increasing order of their reactivity with cold water.
- Did any metal produce fire on water?
- Does any metal start floating after some time?
- Put the metals that did not react with cold water in beakers half-filled with hot water.
- For the metals that did not react with hot water, arrange the apparatus as shown in Fig. 3.3 and observe their reaction with steam.
- Which metals did not react even with steam?
- Arrange the metals in the decreasing order of reactivity with water.

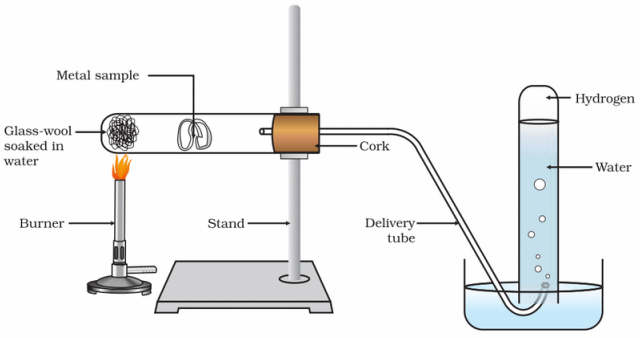


Figure 3.3 *Action of steam on a metal*

Chalo Ab Ise AASAN BHASHA MEI Samajhte hai :

- *A lump of glass wool soaked in water is placed at bottom of tube. The water in glass wool will form steam on heating .*
- *The Sample of metals placed in the middle of the horizontally kept boiling tube. The boiling tube containing water, soaked glass wool and metal sample is arranged in apparatus.*
- *To start the experiment, the metal sample is heated by using a burner when the metal gets hot, then the glass wool is heated by using other burner.*
- *The water present in glass wool forms steam on heating . This steam then passes over the hot metal. The metal react with steam to form the metal oxide and H2 gas.*
- *The H2 gas come out of the boiling tube and it is collected over water when a lighted match stick is applied to gas collected jar, the gas burns with a "pop" sound, indicating that it is hydrogen. The metal oxide formed remains behind in the boiling tube.*

- *This experiment is performed by taking magnesium, aluminium, zinc and iron as metal sample.*
- *It is found that the reaction of steam with magnesium is most vigorous followed by reaction with aluminium and zine but reaction with iron is slowest.*
- *Magnesium is very reactive whereas the iron is least reactive.*
- *Decreasing order Mg › Al › Zn > Fe*
- *Metals like lead, silver and gold do not react with water or even steam.*
- *Only those metals displace hydrogen from water which are hydrogen in the reactivity series.*

Reaction of Metals with Acids

➢ All metals (except less reactive like copper , Hg ,Ag , Au, Pt) reacts with dilute HCl and dilute H2SO4 to produce salt and hydrogen gas.

Metal + dilute acid →salt + Hydrogen

e.g. Zn + 2HCl (aq) → ZnCl2 + H2(g)

➢ Two gases not evolved when a metal reacts with nitric acid(HNo3) as it is a strong oxidising agent .It oxidises H2 produced to H2O and itself gets reduced to any of the nitrogen oxides.

But Mg and Mn reacts with very diluted at HNO3 to evolve to H2 gas.

Metal + HNO3 → Salt + NO2/ N20 + H20

For Mn and Mg = Mn/Mg + HNO3 (dil.) → Salt + H2

Kuch Kaam Ki Baat (K³B) :

Aqua-Regia: Aqua regia is freshly prepared mixture of 1 part of conc. nitric acid and 3 part of conc. HCl.

- Ratio- conc. HN03 : conc. HCL- 1:3 ,it is a highly corrosive fuming liquid.
- Aqua-regia can dissolve all metals.
- Aqua-regia can dissolve even gold and platinum metals.

Reaction of Metals with Other Metal Salts

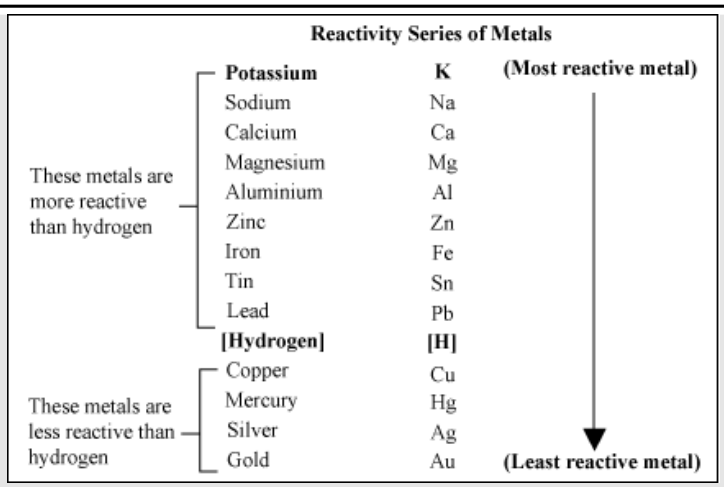
Only more reactive metals can displace a less reactive metal from compound.

Fe + CuSo4 → FeSo4 + Cu

Cu + FeSo4 → X

uch Kaam Ki Baat (K B) :

REACTIVITY SERIES OF METAL: Arrangement of metal in a vertical column in order of decreasing reactivities.



L.P. :

QUESTIONS

1. Why is sodium kept immersed in kerosene oil?
2. Write equations for the reactions of
   (i) iron with steam
   (ii) calcium and potassium with water
3. Samples of four metals A, B, C and D were taken and added to the following solution one by one. The results obtained have been tabulated as follows.

Metal	Iron(II) sulphate	Copper(II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	Displacement		
B	Displacement		No reaction	
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

   Use the Table above to answer the following questions about metals A, B, C and D.
   (i) Which is the most reactive metal?
   (ii) What would you observe if B is added to a solution of Copper(II) sulphate?
   (iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.
4. Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute H_2SO_4.
5. What would you observe when zinc is added to a solution of iron(II) sulphate? Write the chemical reaction that takes place.

Answers:

1. Sodium is highly reactive element, that reacts with oxygen when comes in contact with air and burns. Therefore, it is kept immersed in kerosene for prevention.
2. (i) 3Fe(s) + 4H2O(l) -> Fe3O4 + H2
   (ii) Calcium with water: Ca(s) + 2H2O(l) -> Ca(OH)2(aq) + H2(g)
   Potassium with water: 2K(s) + 2H2O(l) -> 2KOH(aq) + H2(g) + Heat
3. (i) B- It gives displacement reaction with iron(II) sulphate.
   (ii) Displacement reaction will take place , blue colour of Copper(II) Sulphate solution will fade and red-brown deposit of copper will form on B.
   (iii)B,A,C,D
4. Hydrogen gas is produced. {Fe+H2SO4->FeSO4+H2}
5. When zinc is added in the solution , the colour of iron sulphate solution changes. As zinc is more reactive than iron, so it displaces iron from its solution and a grey precipitate of iron and a colourless zinc sulphate is formed.

Zn + FeSO4 -> ZnSO4 + Fe

B. NON-METALS

Those elements which form negative ions by gaining electrons are called non-metals.

Physical Properties of Non Metals

- Are solids or gases except bromine(liquid)
- Except graphite, all are bad conductors of heat and electricity
- Are non ductile
- Have low melting and boiling points
- Are brittle i.e. they breakdown when hammered or streatched.

Chemical Properties of Non Metals

- Non metals are electron acceptor and cannot supply electrons to H+ ions of acids to reduce them to hydrogen gas. Therefore, non metals do not react with water steam or dilute acid.
- With O2 , C + O2 → CO2

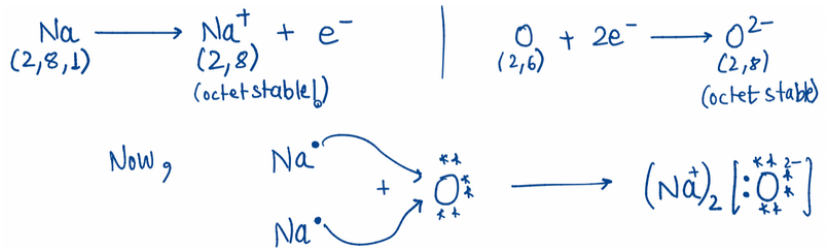
C. METALS+NON METALS

When metals react with non-metals, they form **ionic compounds** and when non-metal react with a non-metal, they form **covalent compound.**

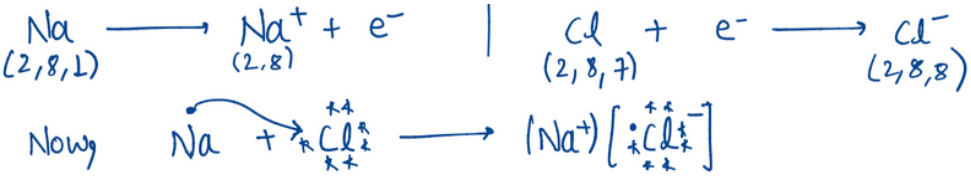
Ionic Compounds

Formed when a metal and a non-metal react. Metal loses electron(s) which is gained by non-metal in such a manner that octet of both is completely filled. These are also called Electrovalent Compounds.

EX: Formation of Na2O:



EX: Formation of NaCl:



Properties of Ionic Compounds

• Solids and crystalline in nature due to strong force of attraction between positive and negative ion.
• Soluble in water and insoluble in solvents such as kerosene and petrol.
• Good conductors of electricity in aqueous solutions and molten state state but do not conduct in the solid state.
• Melting and boiling points are high.

OCCURANCE OF METALS

- Earth's crust is major source of metals.
- Seawater also contains soluble salts like sodium chloride, magnesium chloride etc.
- The elements or compounds which naturally occur in the earth's crust are known as **minerals**.
- Those minerals from which metals can be extracted profitably are called **ores**.

Extraction of Metals from Ores

- "Metallurgy is the process of extraction of metals in pure state from their respective ores and refining them for use."
- The different techniques used for extraction of metals depends upon their position in the activity series.
  - The **highly reactive metals** are generally extracted by '**electrolysis**' due to strong bonding they have with other components of ore. So, cannot be reduced by heating with carbon.
    Example: Potassium (K), Sodium (Na), Calcium (Ca), Magnesium (Mg) etc., are extracted by electrolysis.
  - The **moderately reactive metals** are generally extracted by **reduction** process. This reduction is done with reducing agents like coke (C) etc.
    Example: Zinc (Zn), Iron (Fe), Lead (Pb) etc., are extracted by this method.
  - **Less reactive metals** are extracted from their oxides by **heating** alone(known as self reduction). Example: Copper (Cu), Mercury (Hg).
  - Very less reactive metals are present in free state in nature in the metallic form.
    Example: Silver (Ag), Gold (Au), Platinum (Pt).

Kuch Kaam Ki Baat (K^3B) :

Concentration of Ores:

The undesirable impurities like soil, sand etc, found in ore are called gangue or matrix. Removal of gangue from the ore is called enrichment or concentration of ore.

(I) Extraction of Metals of LOW Reactivity:

By self-reduction- when the sulphide ores of less electropositive metals like Hg, Pb, Cu etc., are heated in air, a part of the ore gets converted to oxide which then reacts with the remaining sulphide ore to give the crude metal and sulphur dioxide. In this process, no external reducing agent is used.

a. Cinnabar(HgS)-

$$2HgS(Cinnabar)+3O2(g)+heat \rightarrow 2HgO(crude\ metal)+2SO2(g)$$
$$2HgO(s)+heat \rightarrow 2Hg(l)+O2(g)$$

b. Copper Glance (Cu2S)

$$Cu2S(Copperpyrite)+3O2(g)+heat \rightarrow 2Cu2O(s)+2SO2(g)$$
$$2Cu2O(s)+Cu2S(s)+heat \rightarrow 6Cu(crude\ metal)+SO2(g)$$

c. Galena (PbS)

$$2PbS(Galena)+3O2(g)+heat \rightarrow 2PbO(s)+2SO2(g)$$
$$PbS(s)+2PbO(s) \rightarrow 2Pb(crudemetal)+SO2(g)$$

(II) Extraction of Metals of MEDIUM Reactivity:

- These metals are usually preset as sulphides or carbonates in nature.
- These sulphides or carbonates are first converted into oxides because it is easy to extract metals from its oxides.
- Sulphides are converted into oxides by **roasting** and carbonates are converted into oxides by **calcination**.
- **Roasting:** Roasting involves heating of ore lower than its melting point in the presence of air or oxygen. Example of Zinc Sulphide ores.

$$\underset{\text{Zinc sulphide}}{2ZnS(s)} + \underset{\text{Oxygen (from air)}}{3O_2(s)} \xrightarrow[\Delta]{\text{Roasting}} \underset{\text{Zinc oxide}}{2ZnO(s)} + \underset{\text{Sulphur dioxide}}{2SO_2(g)}$$

- **Calcination**: Calcination involves thermal decomposition of carbonate ores. Example of Zinc carbonate ore:

$$\underset{\text{Zinc carbonate}}{ZnCO_3(s)} \xrightarrow[\Delta]{\text{Calcination}} \underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

- The metal oxides thus obtained are then reduced to the corresponding metals by reduction process. Depending upon the reactivity of metals, reduction is done in different ways as:
  - **Smelting(Reduction with Carbon):** In this process, the roasted or calcined ore is mixed with suitable quantity of coke or charcoal (which act as reducing agent) and is heated to a high temperature above its melting point. Zinc Example:

$$\underset{\text{Zinc oxide}}{ZnO\,(s)} + \underset{\text{Coke}}{C\,(s)} \longrightarrow \underset{\text{Zinc}}{Zn\,(s)} + \underset{\text{Carbon monoxide}}{CO(g)}$$

  - **Thermite process:** It is the technique, to reduce metal oxide using more reactive metal powder as fuel. Aluminium, magnesium, titanium are some metals which are used as fuel in thermite process. In this process, a mixture of concentrated oxide ore and metal powder (i.e., thermite) is taken in a steel crucible and kept on sand. A mixture of magnesium powder and barium peroxide (called ignition mixture) is used to ignite the reaction mixture. A large amount of hat is evolved during the reaction which melts the metal. Example

$$Cr_2O_3(s) + 2Al(s) \text{ ----->. } 2Cr(l) + Al_2O_3(s)$$

$$Fe_2O_3(s) + 2Al(s) \text{ ----->. } 2Fe(l) + Al_2O_3(s) + \text{Heat}$$

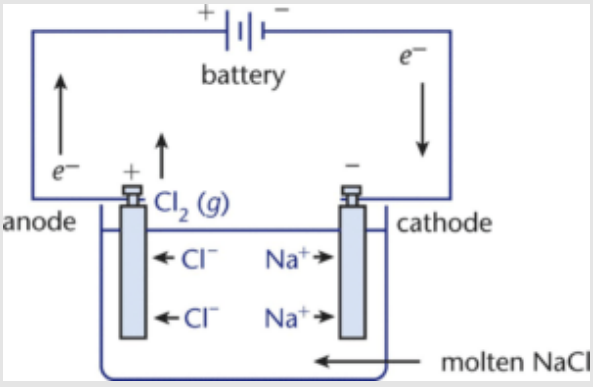
{Gold-Schmidt aluminothermic reduction}

  - **Electrolytic reduction:** Highly reactive metals like Na, K, Mg, Ca, Al, etc, are reduced by electrolysis of their respective oxides, hydroxides of chloride in molten state. On passing electric current into the molten solution, metal is liberated at cathode while impurities are settled down as anode mud generally. Example: Reduction of sodium from NaCl (by electrolysis) as-

$$NaCl \rightarrow Na^+(l) + Cl^-(l)$$

At cathode: reduction of $2Na^+(l) + e^- \rightarrow Na(l)$

At anode: oxidation of $2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$

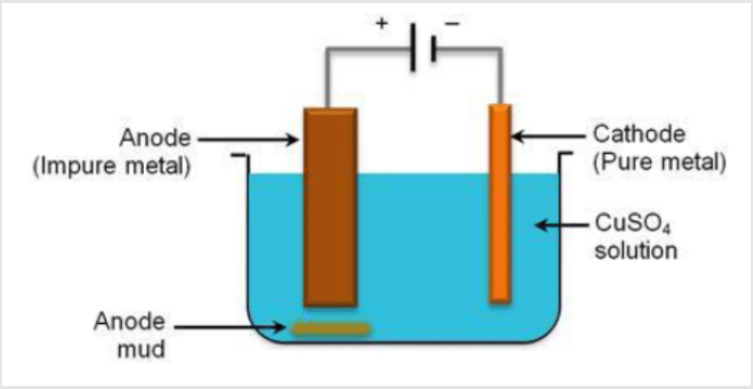


- **Refining/Purification of Metal:** The reduced metals obtained are generally impure which may be associated with following types of impurities as –
  - Uncharged (not reduced) ore.
  - Other metals that are produced by simultaneous reduction of their compounds originally present in the ore
  - Non-metals like silicon, carbon, phosphorous etc.
  - Slag, flux etc., which is present in residual condition.
  - These impurities can be removed by “refining of metals”.

  These Impurities are removed by "**refining of metals**"as:
- **Electrolytic Refining (Purification of copper):** Process In this process, a thick block of impure metal is used as anode and a thin strip of pure metal is used as cathode. A solution of metal salt (to be refined) is used as an electrolyte. When electric current is passed, metal ions from the electrolyte are reduced as metal which get deposited on the cathode. An equivalent amount of pure metal from the anode gets oxidised to metal ion and goes into the electrolyte and from there it goes to cathode and deposit.

At cathode: $Cu^{2+} + 2e^- \rightarrow Cu$

At anode: $Cu \rightarrow Cu^{2+} + 2e^-$



Corrosion

Gradual deterioration of material usually a metal by the action of moisture, air or chemicals in the surrounding environment. Eg- Rusting of iron.

Prevention of Corrosion:

1. Coating with paints or oil or grease: Application of paint or oil or grease on metal surfaces keep out air and moisture.
2. **Alloying**: Alloyed metal is more resistant to corrosion. Example: stainless steel.

3. **Galvanization**: This is a process of coating molten zinc on iron articles. Zinc forms a protective layer and prevents corrosion.
4. **Electroplating**: It is a method of coating one metal with another by the use of electric current. This method not only lends protection but also enhances the metallic appearance.
Example: silver plating, nickel plating.
5. **Sacrificial protection**: Magnesium is more reactive than iron. When it is coated on the articles made of iron or steel, it acts as the cathode, undergoes reaction (sacrifice) instead of iron and protects the articles.

Alloys

Alloys are homogeneous mixtures of metal with other metals or nonmetals. Alloy formation enhances the desirable properties of the material, such as hardness, tensile strength and resistance to corrosion.
Examples of a few alloys:
Brass: copper and zinc
Bronze: copper and tin

-- PREVIOUS YEAR QUESTIONS -

1 MARK QUESTIONS (INCLUDING MCQs)

Q1. Arrange the following metals in the decreasing order of reactivity: Na, K, Cu, Ag. [1 M, 2009]
A1. K > Na > Cu > Ag

Q2. What is the valency of silicon with atomic number 14? [1 M,2010]
A2. Its valency is equal to 4.

Q3. Why does calcium float in water? [1 M,2011]
A3. Calcium sticks to the surface because hydrogen gas is formed which sticks to the surface of calcium, therefore it floats.

Q4. Name two metals which are found in nature in the free state. [1 M,2011]
A4. Gold and Silver are the two metals which are found in nature in the free state.

Q5. Make a distinction between metals and non-metals with respect to the nature of their oxide. [1M,2011]
A5. Metallic oxides are basic, few are amphoteric. Non-metallic oxides are acidic, few are neutral.

Q6. Name a non-metal which is lustrous and a metal which is non-lustrous. [1M,2011]
A6. Iodine (I) is the non-metal which is lustrous , sodium (Na) metal is non-lustrous.

Q7. A green layer is gradually formed on a copper plate left exposed to air for a week in a bathroom. What could this green substance be? [1 M,2012]
A7. It is due to the formation of basic copper carbonate [CuC03. Cu(OH)2].

Q8. What happens when calcium is treated with water? [NCERT Exemplar]
(i). It does note react with water
(ii). It reacts violently with water
(iii). It reacts less violently with water
(iv). Bubbles of hydrogen gas formed, stick to the surface of calcium
(a). (i) and (iv)
(b). (ii) and (ili)
(c). (i) and (ii)
(d). (iii) and (iv)
A8. (d). (i) and (iv)

9. Which one of the following metals would be displaced from the solution of its salts by other three metals? [NCERT Exemplar]
(a). Mg
(b). Ag
(c). Zn
(d). Cu

A9. (d). Cu

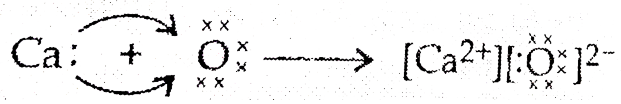
Q10. Which of the following oxide(s) of iron would be obtained on prolonged reaction of iron with steam? [1 M,2020 Delhi]
(a). Fe0
(b). Fe_2O_3
(c). Fe_3O_4
(d). Fe_2O_3 and Fe_3O_4
A10. (c) Fe304

Q11. An element 'X' reacts with 0, to give a compound with a high melting point. This compound is also soluble in water. The element ' X' is [1 M,2020 Delhi]
(a) Iron
(b) Calcium
(c) Carbon
(d) silicon
A11. (b) Calcium.

3 MARKS QUESTIONS

Q12. (a) Sodium chloride is an ionic compound which does not conduct electricity in solid state where as it does conduct electricity in molten state as well as in aqueous solution.
(b) Reactivity of aluminium decrease if it is dipped in nitric acid.
(c) Metals like calcium and magnesium are never found in their free state in nature. [3M,2019]
A 12. (a) Sodium chloride does not conduct electricity in solid state whereas it does conduct electricity in molten state as well as in aqueous solution. This is because in solid state movement of ions is not possible due to rigid structure. Movement of ions is what causes electricity. In molten and aqueous state, ions are free to move and so they conduct electricity.
(b) Reactivity of aluminium decreases if it is dipped in nitric acid, because nitric acid is a strong oxidising agent. As a result, when aluminium is dipped in nitric acid, a layer of aluminium oxide is formed which prevents further reaction of aluminium.
(c) Metals like calcium and magnesium are never found in their free state in nature. This is because they are highly reactive metals and form compounds with almost all elements.

Q13. (a) Explain the formation of ionic compound Cao with electron dot structure. Atomic numbers of calcium and oxygen are 20 and 8 respectively.
(b) Name the constituent metals of bronze. [3M,2012]
A13. (a) Calcium (20) 2,8,8,2 Oxygen (8) 2,6



(b) Bronze is made up of copper and tin.

Q14. (i) Ionic compounds in general have high melting and boiling points.
(ii) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.
(iii) Copper vessels get a green coat when left exposed to air in the rainy season.
[3M,2009]

A14. (i) Ionic compounds have high melting and boiling points due to strong force of attraction between oppositely charged ions.
(ii) It is because these metals themselves are strong reducing agents. Therefore, it cannot be reduced by reducing agents like carbon.
(iii) Copper vessels react with CO2, 02 and moisture to form green-coloured basic copper carbonate
[$CuCO_3$. $Cu(OH)_2$].

Q15. State three reasons for the following facts
(i) Sulphur is a non-metal
(ii) Magnesium is a metal
One of the reasons must be supported with a chemical equation. [3M, 2015]
A15.

Sulphur (non-metal)	**Magnesium (metal)**
1. Sulphur is neither malleable, nor ductile.	1. Magnesium is malleable and ductile
2. It is poor conductor of heat and electricity.	2. It is a good conductor of heat and electricity
3. Sulphur dioxide is basic in nature.	3. Magnesium oxide is acidic in nature.
$S + O_2$ ---> SO_2 $SO_2 + H_2O$----> H_2SO_3 (sulphurous acid)	$2Mg + O_2$ -----> $2MgO$ $MgO + H_2O$---> $Mg(OH)_2$ (magnesium hydroxide)

5 MARKS QUESTIONS

Q16. With the help of a suitable example, explain how ionic compounds are formed. State any three general properties of ionic compounds. [5M, 2011]
A16. Ionic compounds are formed by transfer of electrons from metal to non-metals.
Three general properties of ionic compounds are as follows:
(i) They are solids having high melting point.
(ii) They are soluble in water.
(iii) They conduct electricity in molten state as well as in aqueous solution.

Q17. Give reason:
(i) Aluminium oxide is called an amphoteric oxide.
(ii) An iron strip dipped in a blue copper sulphate solution turns the blue solution pale green.
(iii) Hydrogen gas is not evolved when most metals react with nitric acid.
(iv) Calcium does not occur in a free state in nature.
(v) Sodium or potassium metals are kept immersed under kerosene. [SQP 2020]
A17. (i). Aluminium oxide is known as 'amphoteric oxide' due to its reaction with both acids and bases.
(ii). The iron strip which dipped in the "blue copper sulphate solution" turned into the "blue solution pale green". This is due to the fact that there is "formation of iron sulphate" takes place inside the solution.
(iii). When metals react with the nitric acid, it is oxidised by nitrate ion and not by hydrogen ion.
(iv). Calcium doesn't occur in any 'free state' in nature, because it is "highly reactive in nature".
(v). Sodium and potassium metals are reactive and act violently in presence of air.

Q18. (a) (i) Write two properties of gold which make it the most suitable metal for ornaments.
(ii) Name two metals which are the best conductors of heat.
(ii) Name two metals which melt when you keep them on your palm.
(b) Explain the formation of ionic compound CaO with electron-dot structure. Atomic numbers of calcium and oxygen are 20 and 8 respectively. [5M, 2020]

A18.
(i). The property of gold used in making ornaments is ductility and
lustre.
(ii). Silver are copper are the best conductors of heat.
(iii). Gallium and caesium are the metals that melt when kept on palm.
(iv) Atomic no. of Ca - 20, Electronic Configuration 2,8,8,2
Atomic no. of O - 8 Electronic Configuration - 2,6

ASSERTION AND REASONING QUESTIONS
Rule : Assertion is labelled as (A) and the Reason is labelled as (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :
(a) Both (A) and (R) are true and (R) is the correct explanation of the assertion (A).
(b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true

Q1. Assertion: Sodium and Potassium are highly reactive metals.
Reason: Sodium and Potassium are stored underwater.
A.1 (c) (A) is true, but (R) is false.

Q2. Assertion: When soft iron nails are dipped in a strong solution of copper sulphate, a greenish black solution is formed.
Reason: Iron replaces copper from copper sulphate solution forming iron sulphate
A.2 (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion (A).

Q3. Assertion: Aluminium is more reactive than iron, it's corrosion less than that of iron
Reason: Aluminium is covered with a strong protective layer of oxide which protects the metal from further corrosion.
A.3 (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion (A).