CLASS X
CHEMISTRY

Ch3:
METALS AND NON METALS

Physical Properties of metals and Non metals

S.No.	Property	Metals	Non Metals
1	State	Solid in state except **Mercury** which is a liquid metal	Solid or gaseous in state except **Bromine** which is a liquid non metal
2	Hardness	Hard in nature except **Sodium and Potassium** which are so soft that they can be easily cut using a knife.	Soft in nature except **Diamond** which is the hardest substance on earth.
3	Malleability(Ability to be beaten into sheets)	Malleable	Non Malleable
4	Ductility(Ability to be drawn into wires)	Ductile	Non Ductile
5	Sonority (Production of sound when hit)	Sonorous	Non Sonorous
6	Lustre(Shiny Surface)	Lustrous	Non Lustrous except **Iodine** which are violet coloured shiny crystals.
7	Conduction of heat & Electricity	Good Conductor of heat and Electricity	Bad Conductor except **Graphite** which is a very good conductor
8	Electropositivity or electronegativity	Electropositive in nature as they lose electrons and attain positive charge.	Electronegative in nature as they gain electrons and attain negative charge.
9	Melting and Boiling Point	High Boiling and Melting point except **Caesium** which melts when kept on palm.	Low Melting and boiling point except **Carbon**

Chemical Properties of Metals

1) Reaction of metals with oxygen when burnt in Air
   a) All metals react with oxygen to form corresponding **metal oxides**. These reactions are highly **exothermic**.

Metal + O_2 → Metal Oxide + Heat

$4Na + O_2 \rightarrow 2Na_2O$ + Heat

$4K + O_2 \rightarrow 2K_2O$ + Heat

$2Mg + O_2 \rightarrow 2MgO$ + Heat

$22Cu + O_2 \rightarrow CuO$+ Heat

$4Al + 3O_2 \rightarrow 2Al_2O_3$ + Heat

- **Sodium and Potassium** burn vigorously in air to form oxides, hence catches fire easily. Therefore they **kept under kerosene oil**.
- **Copper** does not burn easily but hot copper develops a layer of black layer of Copper oxide in air.
- **Iron** also does not burn in air but iron fillings when sprinkled in flame burns readily due to increase in surface area of iron under flame.
- **Gold and silver** does not react with air at all.

b) Properties of metal oxides:

- Metal oxides are **basic** in nature. They react with acids to form Salt and Hydrogen Gas.

Acid + Metallic Oxides → Salt + H_2O

$2\ HCl + Na_2O \rightarrow 2\ NaCl + H_2O$

$H_2SO_4 + MgO \rightarrow MgSO_4 + H_2O$

- Some metal oxides (Al_2O_3 and ZnO) are **amphoteric** in nature i.e. they react with acids as well as base.

$2HCl + ZnO \rightarrow ZnCl_2 + H_2O$

$2NaOH + ZnO \rightarrow Na_2ZnO_2 + H_2O$

Sodium Zincate

$6HCl + Al_2O_3 \rightarrow 2\ AlCl_3 + 3H_2O$

$2NaOH + Al_2O_3 \rightarrow 2NaAlO_2 + H_2O$

Sodium Aluminate

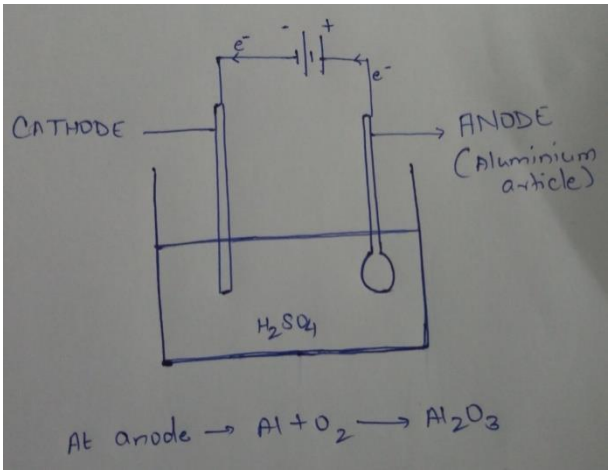
- Metal oxides are **insoluble in water** except Sodium Oxide and Potassium Oxide which dissolve in water to form corresponding Alkali(Bases soluble in water)

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

$K_2O(s) + H_2O(l) \rightarrow KOH(aq)$

c) Corrosion / Annodising

- The chemical process of slow eating up of the surfaces of certain metals when kept in open for a long time. Example: rusting of iron ($Fe_2O_3.xH_2O$), blackening of silver (Ag_2S), green layer on copper ($CuCO_3$).
- In some cases corrosion is helpful, for example corrosion of Aluminium to Aluminium Oxide. Therefore this property is used to prepare corrosion free Aluminium articles.
- **Annodising**: It is an electrolytic process in which an Aluminium article is taken as the anode. The electrolyte used is Sulphuric acid. On **passing the current, oxygen is released at anode** which reacts with Aluminium to form a layer of Aluminium oxide. This layer protects the metal from further corrosion. This layer formed is shiny, so it gives a good lustre to the metal. Since the reaction is taking place at anode, hence the process is known as anodising.



2) Reaction of metals with water

- All metals do not react with water except certain metals.

- Metals which react with water form Metal oxide along with liberation of Hydrogen gas. The soluble **metal hydroxides** further react with water to form metal hydroxide.

  $M + H_20 \rightarrow MO + H_2$

  $MO + H_2O \rightarrow MOH$

- **Sodium and Potassium** reacts violently with water. This reaction is highly exothermic that the evolved Hydrogen gas catches fire.

  $2Na + 2H_2O \rightarrow 2NaOH + H_2$ (Cold Water)

  $2K + 2H_2O \rightarrow 2KOH + H_2$ (Cold Water)

- The reaction of **Calcium** with water is **less violent** so the Hydrogen produced does not catch fire. Calcium **floats** on water due to sticking of hydrogen gas bubbles on the surface of metal.

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

- **Magnesium** reacts with **hot water** to form corresponding hydroxide and Hydrogen gas. Magnesium metal also floats in water.

  $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$ (Hot Water)

- Metals like **Iron, Aluminium and Zinc** reacts with **steam** to form **metal oxides** and Hydrogen gas.

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

  $Zn + H_2O \rightarrow ZnO + H_2$ (Steam)

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

- Other metals like Lead, Silver, gold, Copper do not react with water.

3) Reaction of metals with Acids
   - All metals react with acids to produce respective **salts** along with liberation of **Hydrogen gas.**

     $HCl + Na \rightarrow NaCl + H_2$

     $HCl + Fe \rightarrow FeCl_2 + H_2$

     $HCl + Mg \rightarrow MgCl_2 + H_2$

     $H_2SO_4 + Ca \rightarrow CaSO_4 + H_2$

     $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$

   - Metals do not produce Hydrogen gas with HNO_3 as **Nitric acid** is a strong oxidising agent which oxidises the liberated Hydrogen into Water. Only **Magnesium and Manganese** produces hydrogen gas when reacted with Nitric Acid.
   - **Aqua Regia**: It means Royal Water. It is the only liquid which can dissolve metals like gold, silver and Platinum. It is a highly fuming and corrosive liquid. It is freshly prepared by mixing **Conc. HNO_3 and Conc. HCl in the ratio 1:3.**

4) Reaction of Metals with Aqueous solution of other metal salts.
   - A **more reactive metal displaces a less reactive metal** from its salt solution. This reaction is called displacement reaction

M_A (s) + M_B Salt (aq) → M_A Salt (aq) + M_B↓
Fe (s) +$CuSO_4$ (aq) → Cu (s) + $FeSO_4$ (aq)
Cu (s) + 2$AgNO_3$ (aq) → $Cu(NO_3)_2$ (aq) + 2Ag (s)

- **Reactivity Series/ Activity series**: The arrangement of metals according to their reactivity is called an activity series or a reactivity series.
  K > Na > Ca > Mg > Al > Zn > Fe > Pb > [H] > Cu > Ag > Au > Pt

Ionic Bonding

1) **Noble gas Concept**: Noble gases are those elements which has **completely filled valence shells**.

For Eg.	K	L	M
Helium:	2		
Neon:	2	8	
Argon:	2	8	8

All elements tend to attain noble gas configuration. For this they either lose electrons or gain electrons. When an element loses its electron, it attains a positive charge (Cation) and when any element gains electrons, it attains a negative charge (Anion).

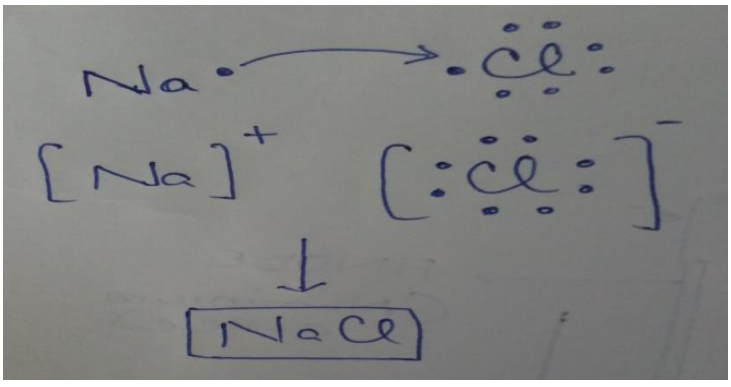
2) What is Ionic Bonding: It is the bond formed due to **transfer of electrons from a metal to a non metal**. On losing electrons metals form cations and on losing electrons non metals form anions. Thus, an electrostatic force of attraction develops between these oppositely charged ions which keep the ions together resulting into formation of a compound.

   Represention of the formation of Ionic Bond:

For example NaCl:	K	L	M		K	L	M
Sodium (Na)	2	8	1	Chlorine(Cl)	2	8	7

$[Na]^+$ $[Cl]^-$ → NaCl

Lewis dot Structure: It is way of representing the elements. According to this pattern the symbol of an element it surrounded by dots equal to the no. of valence electrons present in the element.



3) **Ionic Compounds**: The compounds formed due to transfer of electrons from a metal to a non metal are known as Ionic compounds.
   Ionic Compounds do not consist of molecules, they are basically **aggregates of oppositely charged ions**.
4) Properties of Ionic Compounds
   - These are **solid in state** and do **not vaporize** easily: This is because ionic compounds consist of aggregates of oppositely charged ions which are held together with strong forces of attraction.

- **High Melting and Boiling Point**: This is because ions are held together with strong forces of attraction in the crystal lattice of the ionic compound. Therefore, in order to melt an ionic compound, a large amount of heat energy must be given to pull the ions in the crystal lattice apart from another. The ionic bonds are so strong that a very large amount of energy is required. Hence, a very high temperature is required to melt an ionic compound.
- **Soluble in Water**: Ionic compounds are generally soluble in water but insoluble in organic solvents like alcohol, ether, carbon tetra chloride etc. Although water is a covalent molecule, it does have small positive and negative charges on it. The charges on water molecules attract individual positive and negative ions of the ionic substance and dissolve it.
- Conduction of Electricity:
    a) In the **solid state, ionic compound do not conduct electricity**. In the solid state, the ions cannot move freely. They are held tightly in the crystal lattice by strong electrostatic forces of attraction. The ions can only vibrate. Hence, they do not conduct electricity in the solid state.
    b) In the **molten state or when dissolved in water, ionic compounds are good conductors of electricity.** On dissolving in water, the ions can move freely due to disappearance of electrostatic forces of attraction between the ions. Hence, they conduct electricity when dissolved in water.S

Occurrence of metals/ Metallurgy

1) Concept of Ores and minerals: Very few metals occur in nature in free state. Most of them occur in nature in the combined state. Metals in the top of the reactivity series are very reactive and are never found in nature as free elements. Metals in the middle of the reactivity series are moderately reactive and are mostly present as sulphides, carbonates or oxides. Metals at the end of the reactivity series are least reactive and may be present in the free state or in the combined state.

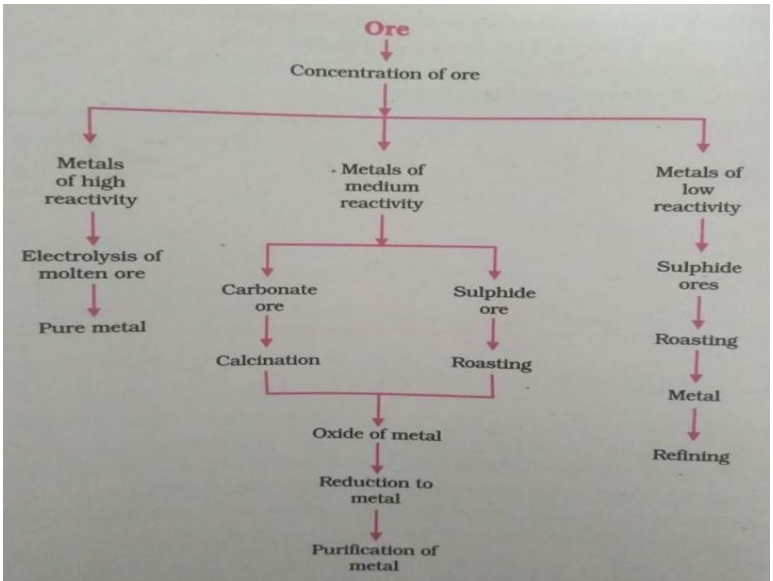
Ores	*Examples*
Sulphides	Copper pyrites, $CuFeS_2$
	Iron pyrites, FeS_2
	Zinc blende, ZnS
	Galena, PbS
	Cinnabar, HgS
Oxides	Cuprite, Cu_2O
	Bauxite, $Al_2O_3.2H_2O$
	Haematite, Fe_2O_3
Carbonates	Calamine, $ZnCO_3$
	Limestone, $CaCO_3$
	Spathic iron, $FeCO_3$
Sulphates	Gypsum, $CaSO_4.2H_2O$
Halides	Horn silver, AgCl

A naturally occurring inorganic substance associated with sandy matter and other impurities are called **minerals**. The minerals from which metals can be extracted profitably are known as **Ores**.

* All ores are minerals but all minerals are not ores.

2) **Metallurgy**: The process of extraction of metals from its ore and refining it for use is called Metallurgy.

3) Steps in Metallurgy
    - Enrichment of ore
    - Extraction of metals from the ore
    - Refining of the metal



4) **Enrichment of Ore**:
    a) The ores mined from the earth re usually contaminated with large amounts of impurities such as sand, soil, other ores etc. These impurities are known as **gangue**.
    b) The ores must be free from the impurities prior to extraction of metals. Different techniques are employed to remove the impurities from the ore. These techniques are based on the difference in the physical and chemical properties of ore and gangue particles.

5) Extraction of Metal

- Introduction: This is the most important step of the metallurgy process. The way of extraction of metal from the enriched ore depends upon the position of metal in the reactivity series.
- The extraction process involves reduction of metal ion into metal.
- Extraction process for **metals low in reactivity series**: The metals low in the reactivity (Hg, Cu, Au, Ag etc.) are very unreactive. These metals can be extracted **by heating their ore in the presence of air (Roasting)**.
    a) **Mercury** is obtained by heating its ore **Cinnabar** (HgS) in air. On heating Cinnabar first gets converted into mercuric oxide (HgO). On further heating, mercuric oxide is then reduced to Mercury.
        $2HgS(s) + 3O_2(g) \rightarrow 2HgO(s) + 2SO_2(g)$
        $2HgO(s) \rightarrow 2Hg(l) + O_2(g)$
    b) **Copper** is generally found in nature as **Copper Sulphide** (Cu_2S). When Cu_2S is heated in air, it first gets converted to Copper Oxide (Cu_2O). On further heating Cu_2O is reduced to Copper. The Copper extracted here is known as Blister Cu.
        $2Cu_2S(s) + 3O_2(g) \rightarrow 2Cu_2O + 2SO_2(g)$
        $2Cu_2O(s) + Cu_2S(s) \rightarrow 6Cu(s) + SO_2(g)$

- Extraction process for **metals middle in reactivity series**: The metals in the middle of the reactivity series are moderately reactive. They occur in nature as oxides, Sulphides and Carbonates. It is easier to obtain metal from its oxide rather than sulphide and carbonate ores, therefore, **first the carbonate and sulphide ores are converted to respective oxides and then metal is extracted from the oxide by reduction process**.
    a) Conversion of carbonate and sulphide ore into Oxide:
        ✓ The process of **heating of suphide ore** in the presence of excess of air to convert into oxide is known as **roasting**. For Eg. Zinc Blende (ZnS) is roasted to form its oxide.
            $2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$
        ✓ The process of **heating of carbonate ore** in the presence of limited amount of of air to convert into oxide is known as **Calcination**. For Eg. Zincite ($ZnCO_3$) is calcined to form its oxide.
            $ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$

    b) Reduction of Metal Oxide to form Metal.
        ✓ The metal oxides are reduced to corresponding metal by using a **suitable Reducing agent such as carbon.** For eg. Zinc oxide is heated with carbon to give Zinc.
            $ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$
        ✓ The **highly reactive meals such as sodium, calcium, Aluminium etc can also be used as reducing agents**. This is because, being more reactive these metals displaces the less reactive metals from their oxides. For eg. Manganese dioxide when heated with Aluminium powder, get reduced to

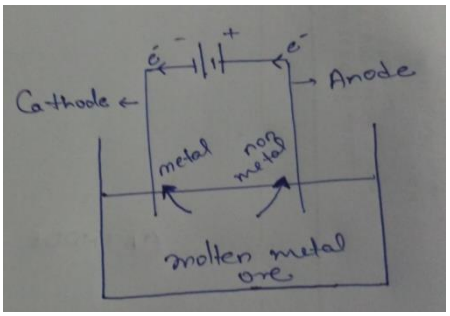
Manganese. The amount of heat evolved in this reaction is so much that the metal is obtained in the molten state.

$3MnO_2(s) + 4Al(s) \rightarrow 3Mn(l) + Al_2O_3(s) + heat$

- ✓ The reduction of Iron (III) oxide (Fe_2O_3) to Iron with Aluminium powder is known as the **Thermite reaction**. This reaction is highly exothermic and is used to join railway tracks and cracked machinery parts.

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + heat$

- Extraction process for **metals high in reactivity series**: The metals (Na, Al, Mg, Ca etc.) which are high up in the reactivity series are very reactive. These metals are obtained by **electrolytic reduction** of their ores.



a) Metals such as **Sodium, magnesium and Calcium** are obtained by the electrolysis of their **molten chlorides**. The metals are deposited at the positive electrode called cathode. Chlorine gas is liberated at the negatively charged electrode called anode.

$NaCl \rightarrow Na^+ + Cl^-$

At Cathode: $Na^+ + e^- \rightarrow Na$

At Anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

b) **Aluminium** is extracted by the electrolytic reduction of **Aluminium oxide (Al_2O_3)**. Aluminium is obtained at the cathode and oxygen gas is liberated at the anode.

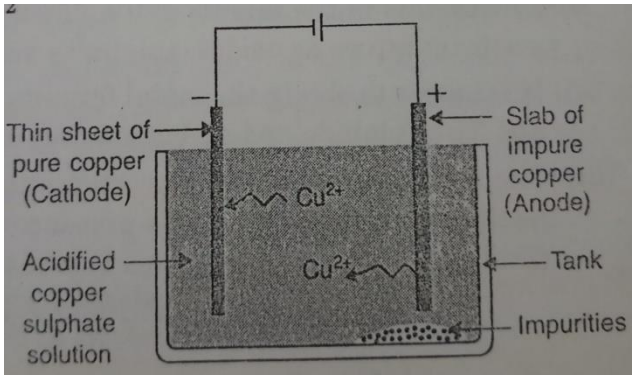
$Al_2O_3 \rightarrow 2Al^{3+} + 3O^{2-}$

At Cathode: $Al^{3+} + 3e^- \rightarrow Al$

At Anode: $2\ O^{2-} \rightarrow O_2 + 4e^-$

6) Refining of metal

- The metals extracted by reduction process in the second step are associated with various impurities. These impurities must be removed to obtain pure metals. The most widely used method for refining the metals is **Electrolytic refining**.
- Electrolytic refining is the process of obtaining pure metal from an impure metal through electrolysis.
- The most important example is the electrolytic refining of Copper. Other metals which are generally refined by electrolysis are Zn, Sn, Ni, Ag, Au etc.
- **Electrolytic refining of Copper**:
  - ✓ Electrolyte used is Aq. Solution of $CuSO_4$ containing small amount of Dil. H_2SO_4. The slab of impure Cu is made as the anode and a thin sheet of pure Cu is made as the cathode.
  - ✓ On passing the electric current, Copper dissolves from the anode into the electrolyte as Cu^{2+} ions.
  - ✓ An equivalent amount of Cu from the electrolyte is deposited at the cathode.



- ✓ The more reactive elements like Fe present as the impurity in the impure copper dissolves in the solution.
- ✓ The less reactive metals such as Ag and Au which are also present as impurities in impure Cu are deposited at the bottom of the anode as anode Mud.
- ✓ Reactions Involved:

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

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

Corrosion

- Corrosion is the process that takes place when a metal is chemically attacked by air, water or any other substance around it. For eg.
  a) When articles made of **silver** are exposed to air, they acquire a blackish tinge after sometime. This is because silver reacts with sulphur present in the air to form **silver sulphide which is black** in colour.
  b) **Copper** has brown shiny surface. When it is exposed to moist air, it reacts with CO2 present in the air and acquires a **green coating of basic Copper carbonate**.
  c) When **Iron** is exposed to moist air for a long time, it acquires a coating of **brown flaky substance called Rust.** This process is called rusting of iron. The Rusting of Iron can be prevented by:
     - ✓ Painting
     - ✓ Oiling and greasing
     - ✓ Galvanising: Coating Iron sheet with a thin layer of Zinc metal.
     - ✓ Chrome plating: Coating Iron sheet with a thin layer of Chromium metal.

Alloys

- **An Alloy is a homogeneous mixture of two or more metals or a metal and a non metal**.
- Alloys are made by melting the main metal and then dissolving the other elements in it in definite proportions. The mixture is then cooled to room temperature.
- The alloys are **made to improve the properties of metals**:
  a) The alloys are **stronger and harder** than metals.
  b) They are **corrosion free**.
  c) The **electrical conductivity and melting point** of an alloy is always **less** than the metal.
- Various examples of alloys are:
  a) An alloy of **mercury** with any metal is known as **Amalgam**.
  b) **Steel**: Iron mixed with 0.05% Carbon
  c) **Stainless steel**: Iron mixed with Nickel and Chromium
  d) **Brass: Copper and Zinc** (used for making Electrical circuits as they are not good conductors
  e) **Bronze: Copper and Tin** of electricity as compared to Copper)
  f) **Solder: lead and Tin** (used as fuse wire and also used to weld electrical wires together called soldering)
  g) **22 carat gold**: 22 parts of pure Gold (24 carat gold) and 2 parts of copper and silver. 24 Carat is pure gold which softer as compared to 22 Carat gold.
- The Iron pillar at Qutub Minar in Delhi was made around 400 BC by Iron workers of India. The Rusting of this wrought iron is till date prevented due to the formation of a thin film of magnetic oxide (Fe_3O_4). On the surface. It was formed by giving a finishing treatment to the pillar, painting it with a mixture of different salts and then by heating and quenching.

ASSIGNMENT

Q1. A non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Q2. Name a non-metal which is lustrous and a metal which is non-lustrous.

Q3. Metals generally occur in solid state. Name and write symbol of a metal that exists in liquid state at room temperature.

Q4 Which of the following two metals will melt at body temperature (37 °C)?
Gallium, Magnesium, Caesium, Aluminium

Q5. Why does calcium float in water?

Q6. Which gas is liberated when a metal reacts with an acid? How will you test the presence of this gas?

Q7. Name the metal which reacts with a very dilute HNO_3 to evolve hydrogen gas.

Q8. Arrange the following metals in the decreasing order of reactivity:
Na, K, Cu, Ag

Q9. From amongst the metals sodium, calcium, aluminium, copper and magnesium, name the metal
(a) which reacts with water only on boiling, and
(b) another which does not react even with steam.

Q10. Which one of the following metals does not react with oxygen even at high temperatures?
(a) Calcium (b) Gold (c) Sodium

Q11. Name any one metal which reacts neither with cold water nor with hot water, but reacts with heated steam to produce hydrogen gas.

Q12. An element forms an oxide, A2O3 which is acidic in nature. Identify A as a metal or non-metal.

Q13. What is the valency of silicon with atomic number 14?

Q14. What is the valency of phosphorus with atomic number 15?

Q15. What is the valency of an element with atomic number 35?

Q16. 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 ?

Q17. Give reason for the following:
(a) School bells are made up of metals.
(b) Electric wire are made up of copper.

Q18. Write one example of each of
(a) A metal which is so soft that, it can be cut with knife and a non-metal which is the hardest subtance.
(b) A metal and a non-metal which exist as liquid at room temperature.

Q19. Name the following:
(a) A metal, which is preserved in kerosene.
(b) A lustrous coloured non-metal.
(c) A metal,which can melt while kept on palm.
(d) A metal, which is a poor conductor of heat.

Q20. Give two examples each of the metals that are good conductors and poor conductors of heat respectively.

Q21. Name a metal/non-metal:
(i) Which makes iron hard and strong?
(ii) Which is alloyed with any other metal to make an amalgam?
(iii) Which is used to galvanise iron articles?
(iv) Whose articles when exposed to air form a black coating?

Q22. Name one metal and one non-metal that exist in liquid state at room temperature. Also name two metals having melting point less than 310 K (37 °C).

Q23. Explain why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some time when immersed in water.

Q24. The way, metals like sodium, magnesium and iron react with air and water is an indication of their relative positions in the ‘reactivity series’. Is this statement true? Justify your answer with examples.

Q25. $X + YSO_4 \rightarrow XSO_4 + Y$
$Y + XSO_4 \rightarrow$ No reaction
Out of the two elements, 'X' and 'Y', which is more reactive and why?

Q26. Which of the following listed metals can displace zinc from its salt solution? Give reason of your answer along with chemical equation.
Copper, Lead, Magnesium, Silver

Q27. When a metal X is treated with cold water, it gives a base Y with molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y and Z.

Q28. Write chemical equations that shows aluminium oxide reacts with acid as well as base.

Q29. Using the electronic configurations, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electrons.

Q30. Elements magnesium and oxygen respectively belong to group 2 and group 16 of the Modern Periodic Table. If the atomic numbers of magnesium and oxygen are 12 and 8 respectively, draw their electronic configurations and show the process of formation of their compound by transfer of electrons.

Q31. Write the electron dot structure for sodium and chlorine atoms. How do these form a chemical bond? Name the type of bond so formed. Why does a compound so formed have high melting point?

Q32. Which one of the methods given in Column I are used for extraction of each of the metals given in Column II.

Column I	Column II
(i) Electrolytic reduction	Al
	Zn
(ii) Reduction with carbon	Na
	Fe
(iii) Reduction with Al	Mn
	Sn

Q33. Mention the names of the metals for the following:
(a) Two metals which are alloyed with iron to make stainless steel.
(b) Two metals which are used to make jewellery.

Q34. What is an alloy? State the constituents of solder. Which property of solder makes it suitable for welding electrical wires?

Q35. A student has been collecting silver coins and copper coins. One day she observed a black coating on silver coins and green coating on copper coins. Give the chemical name of black and green coating. How are they formed?

Q36. What is 24 carat gold? How will you convert it into 18 carat gold?

Q37. You are given samples of three metals: Sodium, magnesium and copper.
Suggest any two activities to arrange them in order of decreasing activity.

Q38. State three reasons for the following facts:
(a) Sulphur is a non-metal (b) Magnesium is a metal
One of the reasons must be supported with a chemical equation.

Q39. Write balanced equations for the reaction of :
(a) Aluminium when heated in air. Write the name of the product.
(b) Iron with steam. Name the product obtained.
(c) Calcium with water. Why does calcium start floating in water?

Q40. Write balanced chemical equations for the following reactions:
(a) Dilute sulphuric acid reacts with aluminium powder.
(b) Dilute hydrochloric acid reacts with sodium carbonate.
(c) Carbon dioxide is passed through lime water.

Q41. What is meant by reactivity series of metals? State which of the following chemical reactions will take place giving suitable reason for each.
(a) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$
(b) $Fe(s) + ZnSO_4(aq) \rightarrow FeSO_4(aq) + Zn(s)$
(c) $Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$