# Chapter 3: Metals and Non-metals

C03

1. **(Activity 3.1) Take samples of iron, copper, aluminium and magnesium. Note the appearance of each sample. Clean the surface of each sample by rubbing them with sand paper and note their appearance again. What do you observe?**

| Metal | Appearance before cleaning | Appearance after cleaning |
|---|---|---|
| Iron | They have shining surface. | They become shinier. |
| Copper | | |
| Aluminium | | |
| Magnesium | | |

2. **(Activity 3.2) Take small pieces of iron, copper, aluminium, and magnesium. Try to cut these metals with a sharp knife and write your observations. Hold a piece of sodium metal with a pair of tongs. Put it on a watch-glass and try to cut it with a knife.**

| Metal | Observation |
|---|---|
| Iron | They are very hard to cut |
| Copper | |
| Aluminium | |
| Magnesium | |
| Sodium | It can be cut easily with a knife. |

3. **(Activity 3.3) Take pieces of iron, zinc, lead and copper. Place each metal on a block of iron and strike it four or five times with a hammer. What do you observe?**

| Metal | Observation |
|---|---|
| Iron | They take the form of sheets on beating. |
| Zinc | |
| Lead | |
| Copper | |

4. **What is meant by malleability?**

   The ability of metals to be beaten into thin sheets is called malleability.

5. **(Activity 3.4) Consider some metals such as iron, copper, aluminium, lead, etc. Which of the above metals are also available in the form of wires?**

   Iron, copper, aluminium, gold, silver, platinum and tin metals are available in the form of wires whereas lead is not available in the form of wire.

6. **What is meant by ductility?**

   The ability of metals to be drawn into thin wires is called ductility.

7. **Give reason: Metals can be given different shapes according to our needs.**

   As metals are malleable and ductile.

8. **State two physical properties of gold which are of extreme use to jewellers.**

   Malleability and ductility

**9. Name some metals that are used for making cooking vessels.**

Aluminium, Copper, Iron are the commonly used metals used for cooking.

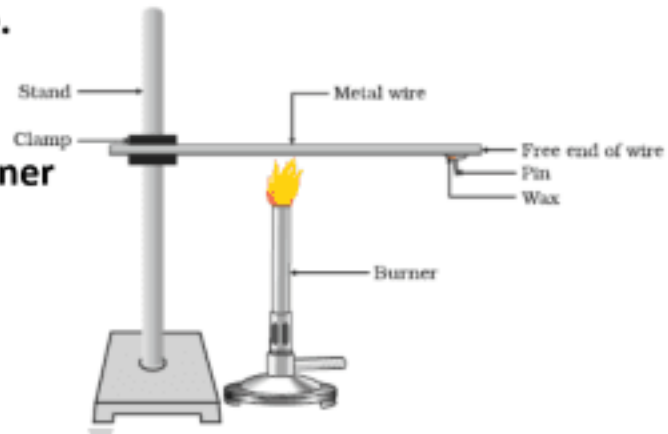
**10. Why are some metals used for making vessels?**

Some metals are used for making vessels because:

a) Their thermal conduction property is very good.

b) They transmit heat easily ensuring that the food gets cooked faster.

**11. (Activity 3.5) Take an aluminium or copper wire. Clamp this wire on a stand as shown in figure. Fix a pin to the free end of the wire using wax. Heat the wire with a spirit lamp, candle or a burner near the place where it is clamped.**
**a) What do you observe after some time?**
**b) Does the metal wire melt?**




a) After some time the wax melts and the pin falls down.

b) No, the metal wire does not melt.

**12. Describe an experiment to show that metals are good conductors of heat.**

Take an aluminium or copper wire. Clamp this wire on a stand as shown in Figure. Fix a pin to the free end of the wire using wax. Heat the wire with a spirit lamp, candle or a burner near the place where it is clamped. After some time the wax melts and the pin falls down. This experiment shows that metals are good conductors of heat and have high melting point.

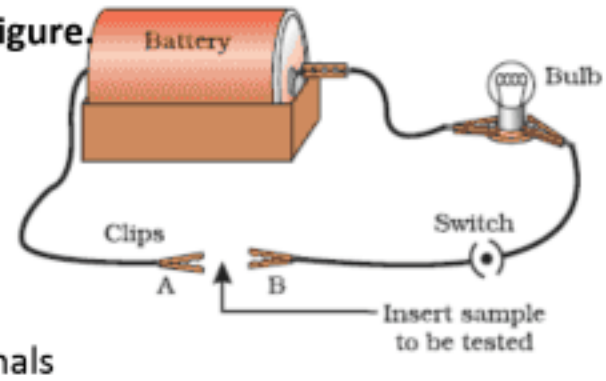
**13. Name the best conductors of heat.**

The best conductors of heat are silver and copper.

**14. Name two metals which are poor conductors of heat.**

Lead and mercury are comparatively poor conductors of heat.

**15. (Activity 3.6) Set up an electric circuit as shown in figure. Place a metal in the circuit between terminals A and B as shown.**
**a) Does the bulb glow?**
**b) What does this indicate?**




a) Yes, the bulb glow.

b) This indicate that metal inserted between terminals A and B, is a conductor of electricity.

**16. Describe an experiment to show that metals are good conductors of electricity.**

Connect a battery, bulb, a switch and two wires with clips at end as shown in the figure. Place a piece of metal in the circuit between the terminals A and B. You observe that the bulb glows when the switch is on. This indicates that metals are good conductors of electricity.

**17. You must have seen that the wires that carry current in your homes have a coating of polyvinylchloride (PVC) or a rubber-like material. Why are electric wires coated with such substances?**

Poly Vinyl Chloride (PVC) is an insulator which means it does not allow electricity to pass through it. It is wrapped around electric wires so that two wires can be placed next to each other. It also prevents electric shocks when we touch the wire.

**18. What happens when metals strike a hard surface?**

The metals produce a sound on striking a hard surface.

**19. What do you mean by metals are sonorous?**

The metals that produce a sound on striking a hard surface are said to be sonorous.

**20. Why school bells are made of metals?**

Metals are sonorous (produce sound on being hit), so - school bells are made up of metals.

**21. Write the physical properties of metals.**

a) Metals, in their pure state, have a shining surface.
b) Metals are generally hard.
c) Some metals can be beaten into thin sheets (Malleable).
d) Some metals can be drawn into thin wires (Ductile).
e) They are good conductors of heat.
f) They have high density and high melting point.
g) They are good conductors of electricity.
h) Most metals produce sound on hitting (sonorous)

**22. State the property utilized in the following:**

**a) Electric wires are coated with PVC or rubber like material.**

Metals are good conductors are electricity.

**b) Metals are used for making bells and strings of musical instruments.**

Metals are sonorous.

**c) Silver foil is spread over sweets.**

Metals are malleable

**d) Copper is used as cables**

Metals are good conductors of electricity / Metal are ductile.

**e) Aluminium is used in making utensils**

Metals are good conductors of heat

**f) Gold is used in making ornaments**

Metals are lustrous.

**23. (Activity 3.7) Collect samples of carbon (coal or graphite), sulphur and iodine. Record your observations.**

| Element | Symbol | Type of surface | Hardness | Malleability | Ductility | Conduction | | Sonority |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Heat | Electricity | |
| Carbon | C | Rough | Moderate | Not Malleable | Not ductile | No | No | No |
| Sulphur | S | Rough | Not hard | Not Malleable | Not ductile | No | No | No |
| Iodine | I | Shiny | Not hard | Not Malleable | Not ductile | No | No | No |

**24. Give reason: We cannot group elements as metals and non-metals according to their physical properties alone.**

As there are many exceptions in metals and non-metals. Example

a) All metals except mercury are solids.

b) Metals generally have high melting points except gallium and caesium.

c) Metals are hard except lithium, sodium and potassium.

d) Non-metals are dull except iodine.

e) Non-metals are bad conductors of electricity except carbon in the form of graphite.

**25. Name the following:**

**a) A metal that is not solid at room temperature.**

Mercury

**b) A metal with very low melting point.**

Gallium/Caesium

**c) A non-metal which is lustrous.**

Iodine

**d) A non-metal that is hardest natural substance.**

Diamond (carbon)

**e) A non-metal that is a good conductor of electricity.**

Graphite (carbon)

**f) A metal that can be cut with a knife.**

Lithium/sodium/potassium

**g) A metal that will melt if kept on your palm.**

Gallium/Caesium

**h) A non-metal having very high melting and boiling point.**

Diamond (carbon)

**i) A metal having low density and low melting point.**

Lithium/sodium/potassium

**26. (Activity 3.8.1) Take a magnesium ribbon. Burn the magnesium ribbon. Collect the ashes formed and dissolve them in water. Test the resultant solution with both red and blue litmus paper. Is the product formed on burning magnesium acidic or basic?**

The product formed is basic.

$2Mg + O_2 \longrightarrow 2MgO$ ; $MgO + H_2O \longrightarrow Mg(OH)_2$

**27. (Activity 3.8.2) Take some sulphur powder and burn it. Place a test tube over the burning sulphur to collect the fumes produced. Add some water to the above test tube and shake. Test this solution with blue and red litmus paper. Is the product formed on burning sulphur acidic or basic? Write equations for these reactions.**

The product formed is acidic

$S + O_2 \longrightarrow SO_2$; $SO_2 + H_2O \longrightarrow H_2SO_4$

**28. Write the physical properties of non-metals.**

a) Non-metals occur as solid, liquid and gas.
b) They do not have shining surface except Iodine.
c) They are generally soft except diamond.
d) They are not malleable.
e) They are not ductile.
f) They are poor conductors of heat.
g) They are poor conductors of electricity except graphite.
h) They have low density and low melting point.
i) They are not sonorous.

**29. Give an example of a metal which**

**(i) is a liquid at room temperature -** Mercury

**(ii) can be easily cut with a knife -** Lithium/sodium/potassium

**(iii) is the best conductor of heat –** silver/copper

**(iv) is a poor conductor of heat –** Mercury/lead

**30. Write differences between metals and non-metals.**

| Metals | Non-metals |
|---|---|
| 1. Metals are solids at solids at room temperature (except mercury & gallium) | 1. Occurs as solids, liquids & gases |
| 2. They are generally hard. | 2. They are generally soft. |
| 3. Sonorous | 3. Not sonorous. |
| 4. Generally malleable & ductile | 4. Non-malleable & non-ductile, brittle |
| 5. Generally good conductors of electricity | 5. Non-conductor of electricity (except graphite) |
| 6. Generally good conductors of heat | 6. Non-conductor of heat (except graphite & diamond) |
| 7. They are lustrous | 7. They are non-lustrous. |
| 8. They have high density and high melting point. | 8. They have low density and low melting point. |
| 9. Metallic oxides are basic in nature. | 9. Non-metallic oxides are acidic in nature. |

**31. (Activity 3.9) Hold each of the following - aluminium, copper, iron, lead, magnesium, zinc and sodium with a pair of tongs and try burning over a flame. Collect the product if formed. Let the products and the metal surface cool down.**

**a) Which metals burn easily?**

Magnesium

**b) What flame colour did you observe when the metal burnt?**

Blue

**c) How does the metal surface appear after burning?**

Silver white

**d) Arrange the metals in the decreasing order of their reactivity towards oxygen.**

Sodium > Magnesium > Aluminium > Zinc > Iron > lead > copper

**e) Are the products soluble in water?**

Oxides of aluminium, copper, iron, lead, magnesium, zinc are not soluble. Sodium oxide is soluble in water.

**32. What happens when a piece of magnesium ribbon is burnt in air?**

Magnesium burns brightly in air forming magnesium oxide.

$2Mg + O_2 \longrightarrow 2MgO$

**33. How do metal react with oxygen?**

Most metals combine with oxygen to form metal oxides.

Metal + Oxygen $\longrightarrow$ Metal oxide

Ex: When copper is heated in air, copper (II) oxide is formed.

$2Cu + O_2 \longrightarrow 2CuO$

Aluminium reacts with oxygen to form aluminium oxide

$4Al + 3O_2 \longrightarrow 2Al_2O_3$

**34. What happens when a foil of copper is heated in a flame?**

A black layer of copper (II) oxide is formed.

$2Cu + O_2 \longrightarrow 2CuO$

**35. What happens when aluminium powder is heated?**

Aluminium burns in oxygen to form aluminium oxide

$4Al + 3O_2 \longrightarrow 2Al_2O_3$

**36. What are amphoteric oxides? Give example.**

Metal oxides which react with both acids as well as bases to produce salts and water are known as amphoteric oxides.

Ex: aluminium oxide, zinc oxide, etc.

**37. How does aluminium oxide react with acid and base?**

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

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

Aluminium oxide reacts with sodium hydroxide to form sodium aluminate and water.

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

**38. How do metal oxides react with water?**

Some metal oxides dissolve in water to from alkalis.

$Na_2O + H_2O \longrightarrow 2NaOH$

$K_2O + H_2O \longrightarrow 2KOH$

**39. Why metals like potassium and sodium are kept immersed in kerosene oil?**

Metals such as potassium and sodium react so vigorously that they catch fire if kept in the open. Hence, to protect them and to prevent accidental fires, they are kept immersed in kerosene oil.

**40. What happens iron filings is sprinkled into the flame of the burner?**

Iron filings burn vigorously when sprinkled in the flame of the burner.

**41. What is anodising?**

Anodising is a process of forming a thick oxide layer of aluminium.

**42. How is anodising process carried out?**

A clean aluminium article is made the anode and is electrolysed with dilute sulphuric acid. The oxygen gas evolved at the anode reacts with aluminium to make a thicker protective oxide layer. This oxide layer is dyed to give aluminium articles an attractive finish.

**43. (Activity 3.10) Put small pieces of the aluminium, copper, iron, lead, magnesium, zinc and sodium separately in beakers half-filled with cold water.**

**a) Which metals reacted with cold water?**

Sodium, Potassium and Calcium are the metals react with cold water.

**b) Arrange them in the increasing order of their reactivity with cold water.**

Calcium < Potassium < Sodium

**c) Did any metal produce fire on water?**

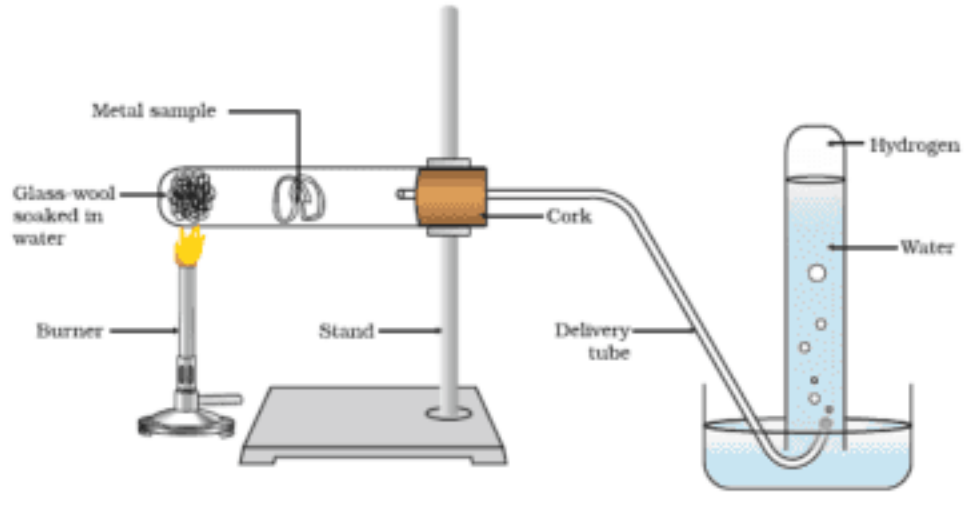
Yes, Sodium and Potassium

**d) Does any metal start floating after some time?**

Calcium

**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, observe their reaction with steam.**




**e) Which metals did not react even with steam?**

Copper, Lead, Silver and Gold do not react with water or steam at all

**f) Arrange the metals in the decreasing order of reactivity with water.**

Sodium > Potassium > Calcium > Magnesium > Aluminium >Iron >Lead > Copper >Silver > Mercury

**44. Draw a labelled diagram to show how metals react with steam to form metal oxide.**

**45. How do metals react with dilute acids?**

Metals react with dilute acids to give salt and hydrogen gas.

Metal + dilute acid $\longrightarrow$ Salt + Hydrogen

**46. (Activity 3.11) Take aluminium, copper, iron, lead, magnesium, zinc. If the samples are tarnished, rub them clean with sand paper. Put the samples separately in test tubes containing dilute hydrochloric acid. Suspend thermometers in the test tubes, so that their bulbs are dipped in the acid. Observe the rate of formation of bubbles carefully.**

The rate of formation of bubbles is fastest in case of magnesium.

**a) Which metals reacted vigorously with dilute hydrochloric acid?**

Metals like magnesium, aluminium, zinc and iron react vigorously with dilute hydrochloric acid.

**b) With which metal did you record the highest temperature?**

Magnesium

**c) Arrange the metals in the decreasing order of reactivity with dilute acids.**

Magnesium > Aluminium > zinc > iron

**47. Write equation for the reaction between the following metals and hydrochloric acid.**

a) **Magnesium** $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

b) **Aluminium** $2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$

c) **Zinc** $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

d) **Iron** $Fe + 2HCl \longrightarrow FeCl_2 + H_2$

e) **Copper** Copper does not react with dilute hydrochloric acid.

**48. Sodium displaces hydrogen from dilute acids violently but copper does not displace hydrogen from dilute acids. Why?**

Copper is less reactive than hydrogen and they do not replace hydrogen from water or acid.

**49. How do the following react with very dilute nitric acid?**

**a) Magnesium**

$Mg + 2HNO_3 \longrightarrow Mg(NO_3)_2 + H_2$

**b) Manganese**

$Mn + 2HNO_3 \longrightarrow Mn(NO_3)_2 + H_2$

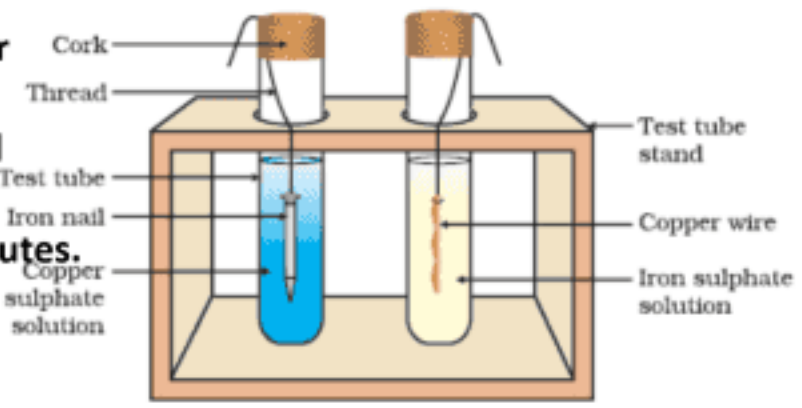
**50. Why hydrogen gas is not evolved when some metals react with nitric acid?**

Nitric acid is a strong oxidising agent. It oxidizes the hydrogen gas produced to water.

**51. What is aqua regia?**

Aqua regia is a freshly prepared mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio of 3:1.

**52. (Activity 3.12) Take a clean wire of copper and an iron nail. Put the copper wire in a solution of iron sulphate and the iron nail in a solution of copper sulphate taken in test tubes. Leave the test tube for 20 minutes.**




**a) In which test tube did you find that a reaction has occurred?**

The reaction occurs in the test tube
in which iron nail is placed in solution of copper sulphate.

**b) On what basis can you say that a reaction has actually taken place?**

The iron nail gets coated with a layer of red copper metal, it is observed that in the first test tube no reaction has occurred.

**c) Can you correlate your observations for the Activities 3.9, 3.10 and 3.11?**

In this reaction, a more active metal, iron displaces a less reactive metal, copper from it compound copper (II) sulphate.

**d) Write a balanced chemical equation for the reaction that has taken place.**

$CuSO_4 + Fe \longrightarrow FeSO_4 + Cu$

**e) Name the type of reaction.**

Displacement reaction.

**53. An aluminium can is used to store ferrous sulphate solution. It is observed that in a few days holes appeared in the can. Explain the cause for this observation and write chemical equation to support your answer.**

Aluminium is more reactive than iron. Therefore aluminium slowly reacts with solution of ferrous sulphate and holes are developed in the aluminium can.

$2Al(s) + 3FeSO_4(aq) \longrightarrow Al_2(SO_4)_3 + 3Fe(s)$

**54. Which metal, copper or iron, is more reactive?**

Iron is more reactive as iron displaces copper from copper oxide.

**55. Write equations for the reactions of (i) iron with steam (ii) calcium and potassium with water**

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

ii) $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2 + Heat$

iii) $2K + 2H_2O \longrightarrow 2KOH + H_2 + Heat$

**56. 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?**

$A + FeSO_4 \rightarrow$ No reaction, i.e., A is less reactive than iron

$A + CuSO_4 \rightarrow$Displacement, i.e., A is more reactive than copper

$B + FeSO_4 \rightarrow$ Displacement, i.e., B is more reactive than iron

$B + ZnSO_4 \rightarrow$No reaction, i.e., B is less reactive than zinc

$C + FeSO_4 \rightarrow$ No reaction, i.e., C is less reactive than iron

$C + CuSO_4 \rightarrow$No reaction, i.e., C is less reactive than copper

$C + ZnSO_4 \rightarrow$No reaction, i.e., C is less reactive than zinc

$C + AgNO_3 \rightarrow$ Displacement, i.e., C is more reactive than silver

$D + FeSO_4/CuSO_4/ZnSO_4/AgNO_3 \rightarrow$No reaction, i.e., D is less reactive than iron, copper, zinc, and silver

Therefore B is the most reactive metal.

**(ii) What would you observe if B is added to a solution of Copper (II) sulphate?**

If B is added to a solution of copper (II) sulphate, then it would displace copper.

$B + CuSO_4 \rightarrow$Displacement

**(iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.**

The arrangement of the metals in the order of decreasing reactivity is B > A > C > D

**57. Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute $H_2SO_4$.**

Hydrogen gas is evolved when dilute hydrochloric acid is added to a reactive metal. When iron reacts with dilute $H_2SO_4$, iron (II) sulphate with the evolution of hydrogen gas is formed.

$Fe + H_2SO_4 \longrightarrow FeSO_4 + H_2$

**58. What would you observe when zinc is added to a solution of iron (II) sulphate? Write the chemical reaction that takes place.**

Zinc is more reactive than iron. Therefore, if zinc is added to a solution of iron (II) sulphate, then it would displace iron from the solution. $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

**59. In test tubes A and B, zinc sulphate solution and silver nitrate solution are taken respectively. Copper turnings are added to both test tubes. In which of the two test tubes do you observe the reaction? Justify your answer with scientific reason.**

Test tube B containing silver nitrate solution. Because copper being more reactive than silver, displaces silver from silver nitrate solution.

**60. The given equation represents the reaction of copper sulphate with an element x.**

**$CuSO_4 + X \longrightarrow Cu + Y$**

**Which element is represented by X, among Fe and Ag? Justify your answer. Write the molecular formula of the compound represented by Y.**

Element X is Fe. The reactivity of iron is more than that of copper. Compound Y is $FeSO_4$.

**61. Define reactivity of elements.**

Reactivity of elements is a tendency to attain a completely filled valence shell.

**62. How is a sodium ion formed?**

Sodium atom has one electron in its outermost shell. If it loses the electron from its M shell then its L shell now becomes the outermost shell and that has a stable octet. The nucleus of this atom still has 11 protons but the number of electrons has become 10, so there is a net positive charge giving us a sodium cation $Na^+$.

$$\underset{2,8,1}{Na} \longrightarrow \underset{\text{(Sodium cation)}}{Na^+} + e^-$$

**63. Explain how chloride ion is formed.**

Chlorine has seven electrons in its outermost shell and it requires one more electron to complete its octet. If sodium and chlorine were to react, the electron lost by sodium could be taken up by chlorine. After gaining an electron, the chlorine atom gets a unit negative charge, because its nucleus has 17 protons and there are 18 electrons in its K, L and M shells. This gives us a chloride anion $Cl^-$.

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{\text{(Chloride anion)}}{Cl^-}$$

**64. Explain the formation of sodium chloride.**

Sodium atom has one electron in its outermost shell. It loses one electron and becomes sodium ion. Chlorine has seven electrons in its outermost shell and it requires one more electron to complete its octet. If sodium and chlorine react, the electron lost by sodium is taken up by chlorine. Sodium and chloride ions, being oppositely charged, attract each other and are held by strong electrostatic forces of attraction to exist as sodium chloride (NaCl).

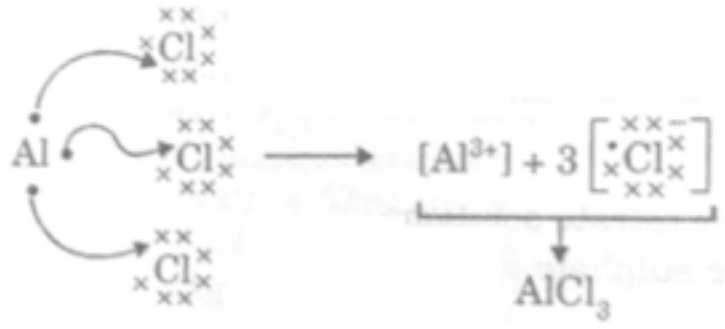

**65. Explain the formation of magnesium chloride.**

Magnesium atom has two electrons in its outermost shell. It loses two electrons and becomes magnesium ion. Chlorine has seven electrons in its outermost shell and requires one electron to complete its octet. If magnesium and chlorine react, two electrons lost by magnesium are taken by chlorine and magnesium chloride is formed.

**66. Show the formation of aluminium chloride by the transfer of electrons between the atoms (atomic number of aluminium and chlorine are 13 and 17 respectively).**

$$\underset{(2,8,3)}{Al} \longrightarrow \underset{(2,8)}{Al^{3+}} + 3e^-$$

$$\underset{(2,8,7)}{Cl} + e^- \longrightarrow \underset{(2,8,8)}{Cl^-}$$




**67. What are ionic compounds or electrovalent?**

The compounds formed by the transfer of electrons from a metal to a non-metal are known as ionic compounds or electrovalent compounds.

**68. Name the cation and anion present in $MgCl_2$.**

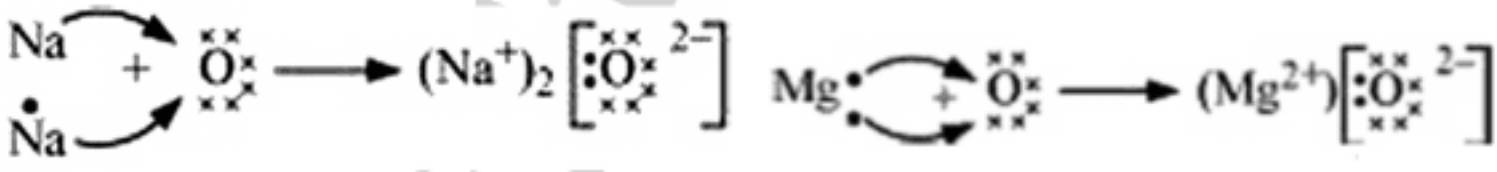
Mg is cation and Cl is anion.

**69. Write the electron-dot structures for sodium, oxygen and magnesium.**

a) Sodium - $\dot{Na}$ b) Oxygen - $:\ddot{O}:$

c) Magnesium - $\ddot{M}g$

**70. Show the formation of $Na_2O$ and MgO by the transfer of electrons. What are the ions present in these compounds?**



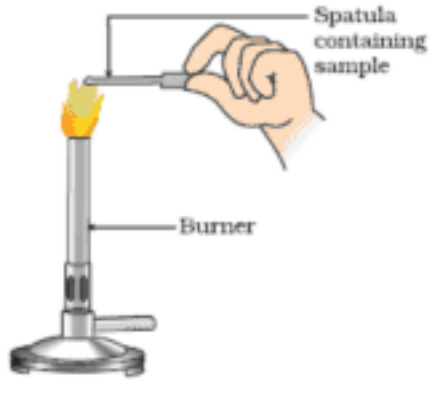
The ions present in $Na_2O$ are $Na^+$ and $O^{2-}$ ions and in MgO are $Mg^{2+}$ and $O^{2-}$ ions.

**71. (Activity 3.13) Take samples of sodium chloride, potassium iodide, barium chloride or any other salt from the science laboratory.**

**a) What is the physical state of these salts?**

All the salts are solids.

**Take a small amount of a sample on a metal spatula and heat directly on the flame as shown in the figure.**




**b) What did you observe? Did the samples impart any colour to the flame? Do these compounds melt?**

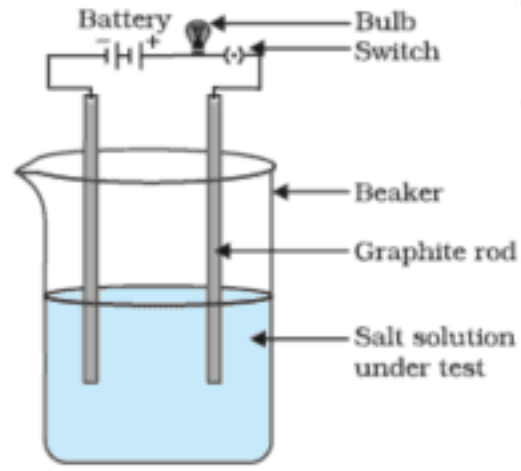
Sodium chloride burns with yellow flame, potassium iodide with pale violet and barium chloride with a pink colour. These compounds melt at high temperatures.

**Try to dissolve the samples in water, petrol and kerosene.**

**c) Are they soluble?**

Metal compounds dissolve in water but are insoluble in petrol and kerosene.

**Make a circuit as shown in figure and insert the electrodes into a solution of one salt. What did you observe? Test the other salt samples too in this manner.**




Metal compounds conduct electricity in water only, not in petrol or kerosene.

**d) What is your inference about the nature of these compounds?**

These compounds give charged ions in water.

**72. Write the general properties of ionic compounds.**

a) Ionic compounds are solids. They are brittle and break into pieces when pressure is applied.

b) Ionic compounds have high melting and boiling points.

c) Ionic compounds are soluble in water and insoluble in organic solvents such as kerosene, petrol etc.

d) Ionic compounds conduct electricity in molten state.

**73. Give scientific reason for:**

**a) Ionic compounds are solids and hard.**

Due to the strong force of attraction between the positive and negative ions.

**b) Ionic compounds have high melting & boiling points.**

As considerable amount of energy is required to break the strong inter-ionic attraction.

**c) Ionic compounds in solid state do not conduct electricity.**

Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid is not possible due to their rigid structure.

**d) Ionic compounds conduct electricity in molten state.**

Ionic compounds conduct electricity in the molten state since the electrostatic forces of attraction between the oppositely charged ions are overcome due to the heat.

**74. What are minerals?**

The elements or compounds, which occur naturally in the earth's crust, are known as minerals.

**75. What are ores?**

Minerals that contain a very high percentage of a particular metal which can be profitably extracted from it are called ores.

**76. Name the ores of the following:**

a) Mercury – cinnabar (HgS)

b) Copper - Chalcocite ($Cu_2S$)

c) Zinc – zinc blende (ZnS) or calamine ($ZnCO_3$)

**77. Name the metals which are found in free state.**

The metals that are found at the bottom of the activity series which are least reactive. Example: gold, silver, platinum and copper.

**78. Name the metals which are found in combined state.**

Copper, silver, metals found at the top of the activity series like potassium, sodium, calcium, magnesium, aluminium, zinc, iron, lead, etc.

**79. Why are elements like potassium, sodium not found in free state?**

The metals at the top of the activity series like potassium, sodium, calcium, magnesium, aluminium are so reactive that they are never found in nature as free elements.

**80. Why are elements like zinc, iron, lead, etc., found mostly as oxides, sulphides or carbonates?**

Zinc, iron lead, etc., are found in the earth's crust mainly as oxides, sulphides or carbonates because oxygen is a very reactive element and is very abundant on the earth.

**81. How can metals be classified on the basis of reactivity?**

(i) Metals of low reactivity; (ii) Metals of medium reactivity; (iii) Metals of high reactivity.

**82. How are metals of high reactivity extracted?**

Metals of high reactivity like potassium, sodium, calcium, magnesium and aluminium are extracted by electrolysis of molten ore.

**83. Write the steps involved in extraction of carbonate ores of metals of medium reactivity.**

a) Concentration of ore.

b) Calcination of carbonate ore to obtain oxide of metal.

c) Reduction to metal.

d) Purification of metal.

**84. Write the steps involved in extraction of sulphide ores of metals of medium reactivity.**

a) Concentration of ore.

b) Roasting of sulphide ore to obtain oxide of metal.

c) Reduction to metal.

d) Purification of metal.

**85. Write the steps involved in extraction of metals of low reactivity.**

a) Concentration of ore.

b) Roasting of sulphide ore.

c) Refining of metal.

**86. What is gangue?**

Large amounts of impurities such as soil, sand, etc., present along with the ore are called gangue.

**87. How is mercury extracted from cinnabar?**

Cinnabar (HgS) is an ore of mercury. It is heated in air to convert into mercuric oxide (HgO). Mercuric oxide is then reduced to mercury on further heating.

$2HgS(s) + 3O_2(g) \xrightarrow{Heat} 2HgO(s) + 2SO_2(g)$

$2HgO(s) \xrightarrow{Heat} 2Hg(l) + O_2(g)$

**88. How is copper extracted from Chalcocite ($Cu_2S$)?**

Copper which is found as Chalcocite ($Cu_2S$) in nature can be obtained by just heating in air.

$2Cu_2S + 3O_2\,(g) \xrightarrow{Heat} 2Cu_2O(s) + 2SO_2\,(g)$

$2Cu_2O + Cu_2S \xrightarrow{Heat} 6Cu(s) + SO_2\,(g)$

**89. What is meant by roasting?**

The process in which sulphide ores are converted into oxides by heating them strongly in excess of air is known as roasting.

**90. What is meant by calcination?**

The process in which the carbonate ores are changed into oxides by heating strongly in limited air is called calcination.

**91. Distinguish between roasting and calcination.**

| Roasting | Calcination |
|---|---|
| 1. The ore is heated in presence of air | 1. The ore is heated in absence of air |
| 2. It is used for sulphide ores. | 2. It is used for carbonate ores. |

**92. How is zinc extracted from its ore (zinc blende ZnS)?**

Zinc blende (ZnS) is converted into zinc oxide by heating strongly in the presence of air.

$2ZnS(s) + 3O_2(g) \xrightarrow{Heat} 2ZnO(s) + 2SO_2(g)$

Zinc oxide is heated with carbon to reduce it to metallic zinc.

$ZnO(s) + C(s) \longrightarrow Zn(s) + CO(g)$

**93. Name the reducing agent used in the extraction of zinc.**

Carbon

**94. How is zinc extracted from its ore (calamine $ZnCO_3$)?**

Calamine or $ZnCO_3$ is changed into zinc oxide by heating strongly in limited air.

$ZnCO_3(s) \xrightarrow{Heat} ZnO(s) + CO_2(g)$

Zinc oxide is heated with carbon to reduce it to metallic zinc.

$ZnO(s) + C(s) \longrightarrow Zn(s) + CO(g)$

**95. Give reason: Highly reactive metals are used as reducing agents.**

Highly reactive metals such as sodium, calcium, aluminium, etc., are used as reducing agents because they can displace metals of lower reactivity from their compounds.

**96. How is manganese extracted from it ore (pyrolusite)?**

Manganese dioxide (pyrolusite) is heated with aluminium powder to get manganese.

$3MnO_2(s) + 4Al(s) \longrightarrow 3Mn(l) + 2Al_2O_3(s) + Heat$

**97. Identify the substance getting oxidised and reduced in the following equation.**
**$3MnO_2(s) + 4Al(s) \longrightarrow 3Mn(l) + 2Al_2O_3(s) + Heat$**

Manganese dioxide ($MnO_2$) is getting reduced. Aluminium is getting oxidised.

**98. How is iron (III) oxide reduced to iron using aluminium?**

Iron (III) oxide ($Fe_2O_3$) is heated with aluminium powder, it gets reduced to iron.

$Fe_2O_3(s) + 2Al(s) \longrightarrow 2Fe(l) + Al_2O_3(s) + Heat$

**99. What is meant by thermite reaction?**

Thermite reaction is an exothermic redox reaction between a metal and metal oxide as reactants.

**100. Give reason: Thermite process is used to join railway tracks or cracked machine parts.**

Thermite reactions are highly exothermic. The amount of heat evolved is so large that the metals are produced in the molten state. Hence used to join railway tracks or cracked machine parts.

**101. Why highly reactive metals cannot be reduced with carbon?**

Carbon cannot reduce the oxides of sodium, magnesium, calcium, aluminium, etc., to the respective metals because these metals have more affinity for oxygen than carbon.

**102. What is electrolytic reduction?**

Electrolytic reduction is the method of reducing metals with the help of electrolysis.

**103. Which chemical process is used for obtaining a metal from its oxide?**

Reduction

**104. How is sodium obtained by electrolytic reduction?**

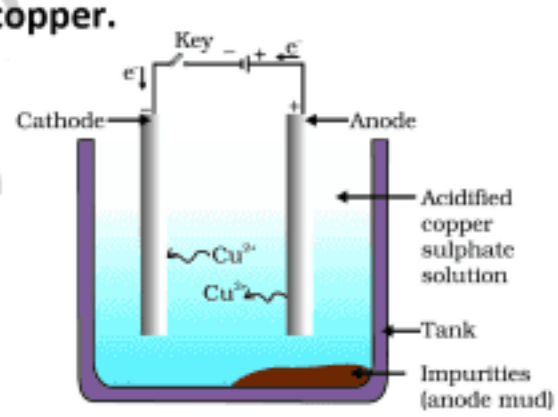
If sodium chloride is melted, two electrodes are inserted and an electric current is passed through the molten salt, then chemical reactions take place at the electrodes. Sodium is deposited at the cathode (negatively charged electrode) and chlorine is liberated at the anode (positively charge electrode)

**105. Write the reaction that takes place at cathode and anode during the electrolytic reduction of sodium.**

At cathode: $Na^+ + e^- \longrightarrow Na$ At anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$

**106. Briefly explain the electrolytic refining of copper.**

In the electrolytic refining of copper, impure copper is taken as anode and pure copper strips are taken as cathode. The electrolyte is acidified solution of copper sulphate.
On passing electric current, pure copper is deposited on the cathode.




The reactions are:

Anode: $Cu \longrightarrow Cu2+ + 2e^-$ Cathode: $Cu^{2+} + 2e^- \longrightarrow Cu$

**107. Draw a neat diagram of the apparatus used in the electrolytic refining of copper.**

**108. What is anode mud?**

During electrolytic refining of metals, the insoluble impurities that settle down at the bottom of the anode is called anode mud.

**109. Give reasons:**

**a) Silver articles become black after exposure to air.**

Silver reacts with sulphur in the air to form a coating of silver sulphide.

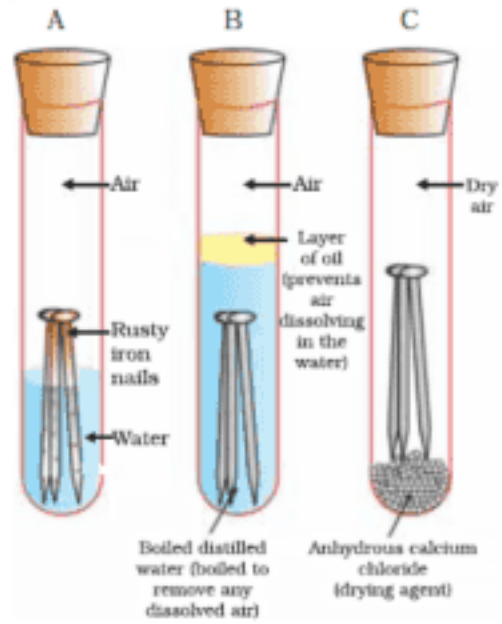
**b) Copper articles becomes green after exposure to air.**

Copper reacts with moist carbon dioxide in the air and slowly loses its shiny brown surface and forms a green copper carbonate.

**c) Iron articles acquires a coating of a brown flaky substance.**

Iron on exposure to moist air for a long time forms iron oxide.

**110. (Activity 3.14) Take three test tubes and place clean iron nails in each of them. Label these test tubes A, B and C. Pour some water in test tube A and cork it. Pour boiled distilled water in test tube B, add about 1 mL of oil and cork it. The oil will float on water and prevent the air from dissolving in the water. Put some anhydrous calcium chloride in test tube C and cork it. Leave these test tubes for a few days and then observe.**




In test tube C, anhydrous calcium chloride will absorb the moisture from the air. Only dry air is present without water. So no rusting takes place.

In test tube B, the layer of oil prevents air dissolving in water. Boiled distilled water removes the dissolved air. Only water is present without water. So no rusting takes place.

In test tube A, iron nail is exposed to both air and water. Hence rusting is seen.

This shows that both air and water are necessary for corrosion of iron.

**111. State the methods of preventing corrosion of iron.**

Rusting of iron can be prevented:

a) By painting.

b) By oiling.

c) By greasing.

d) By galvanizing.

e) By anodising or making alloys.

**112. What is meant by galvanisation?**

Galvanisation is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc.

**113. Give reason: Galvanised article is protected against rusting even if the zinc coating is broken.**

Zinc is more reactive than iron, and loses electrons more easily. When zinc layer breaks down, the outer layer of zinc reacts with the atmospheric oxygen to form zinc Oxide (ZnO), which is stronger than zinc.

**114. Give reason: Iron is not used in its pure state.**

Pure iron is very soft and stretches easily when hot.

**115. How can pure iron be made**

**a) Hard and strong?**

If iron is mixed with small amount of carbon (about 0.05%), it becomes hard and strong.

**b) Hard and rust free?**

If iron is mixed with nickel and chromium, it can be made hard and rust free.

**116. Pure iron is soft and stretches easily when hot. How do these properties of iron change when**
**a) small amount of carbon is mixed with it? b) Nickel and chromium are mixed with it?**

a) If iron is mixed with small amount of carbon (about 0.05%), it becomes hard and strong.

b) If iron is mixed with nickel and chromium, it can be made hard and rust free.

**117. What is an alloy?**

An alloy is a homogeneous mixture of two or more metals, or a metal and a nonmetal.

**118. How are alloys prepared?**

Alloy is prepared by first melting the primary metal, and then, dissolving the other elements in it in definite proportions. It is then cooled to room temperature.

**119. Give reason: Pure gold (24 carat) is not suitable for making jewellery.**

Pure gold is very soft hence it is not suitable for making jewellery.

**120. Why is silver or copper added to make gold jewellery?**

Pure gold (24 carat) is very soft, so to make it hard silver or copper is added.

**121. What happens to the property of the ornaments made of gold is not mixed with copper?**

Ornaments made of pure gold will be very soft & cannot retain the shape.

**122. What is meant by 22 carat gold?**

22 carat gold means 22 parts of pure gold is mixed with 2 parts of either copper or silver.

**123. What is meant by amalgam?**

An alloy of mercury with another metal is called an amalgam.

**124. State the composition and one use of the following alloys.**

| Alloy | Composition | Use |
|---|---|---|
| Brass | Copper and zinc | Electrical appliances |
| Bronze | Copper and tin | statues |
| Solder | Lead and tin | Welding electrical wires |

**125. Give reason: Solder is used for welding electrical wires together.**

Solder an alloy of lead and tin has a low melting point hence used for welding electrical wires together.

**126. Metallic oxides of zinc, magnesium and copper were heated with the following metals. In which cases will you find displacement reactions taking place?**

| Metal | Zinc | Magnesium | Copper |
|---|---|---|---|
| Zinc oxide | No | Yes | No |
| Magnesium oxide | No | No | No |
| Copper oxide | Yes | Yes | No |

**127. Which metals do not corrode easily?**

Gold and platinum

**128. You are given a hammer, a battery, a bulb, wires and a switch. (a) How could you use them to distinguish between samples of metals and non-metals? (b) Assess the usefulness of these tests in distinguishing between metals and non-metals.**

(a) With the hammer, we can beat the sample and if it can be beaten into thin sheets (that is, it is malleable), then it is a metal otherwise a non-metal. Similarly, we can use the battery, bulb, wires, and a switch to set up a circuit with the sample. If the sample conducts electricity, then it is a metal otherwise a non-metal.

(b) The above tests are useful in distinguishing between metals and non-metals as these are based on the physical properties. No chemical reactions are involved in these tests.

**129. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.**

Metals that are more reactive than hydrogen displace it from dilute acids. Example: sodium and potassium. Metals that are less reactive than hydrogen do not displace it. Example: copper and silver.

**130. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?**

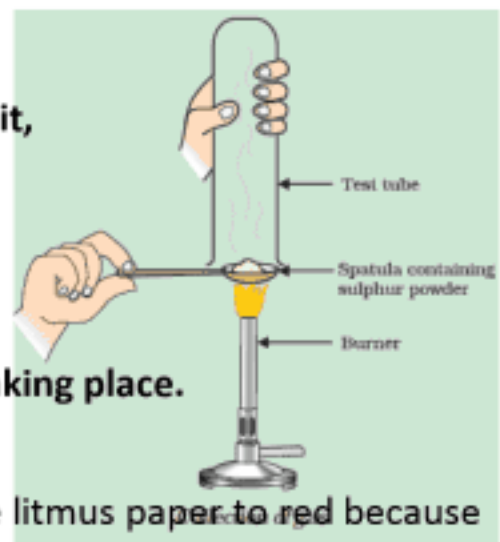
In the electrolytic refining of a metal M:

Anode → Impure metal M

Cathode → Thin strip of pure metal M

Electrolyte → Solution of salt of the metal M

**131. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it, as shown in figure.**




**(a) What will be the action of gas on**
**(i) dry litmus paper?**
**(ii) moist litmus paper?**
**(b) Write a balanced chemical equation for the reaction taking place.**

(a) (i) There will be no action on dry litmus paper.

(ii) Since the gas is sulphur dioxide ($SO_2$), it turns moist blue litmus paper to red because sulphur dioxide reacts with moisture to form sulphurous acid.

b) $S(s) + O_2(g) \longrightarrow SO_2(g)$; $SO_2(g) + H_2O(l) \longrightarrow H_2SO_3(aq)$

**132. What type of oxides are formed when non-metals combine with oxygen?**

Non-metals combine with oxygen to form acidic oxides. $S(s) + O_2(g) \longrightarrow SO_2(g)$

**133. Give reasons**

**(a) Platinum, gold and silver are used to make jewellery.**

Platinum, gold, and silver are used to make jewellery because they are very lustrous. Also, they are very less reactive and do not corrode easily.

**(b) Sodium, potassium and lithium are stored under oil.**

Sodium, potassium, and lithium are very reactive metals and react very vigorously with air as well as water. Therefore, they are kept immersed in kerosene oil in order to prevent their contact with air and moisture.

**(c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.**

Though aluminium is a highly reactive metal, it is resistant to corrosion. This is because aluminium reacts with oxygen present in air to form a thin layer of aluminium oxide. This oxide layer is very stable and prevents further reaction of aluminium with oxygen. Also, it is light in weight and a good conductor of heat. Hence, it is used to make cooking utensils.

**(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.**

Carbonate and sulphide ores are usually converted into oxides during the process of extraction because metals can be easily extracted from their oxides rather than from their carbonates and sulphides.

**134. You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.**

Copper reacts with moist carbon dioxide in air to form copper carbonate and as a result, copper vessel loses its shiny brown surface forming a green layer of copper carbonate. The citric acid present in the lemon or tamarind neutralises the basic copper carbonate and dissolves the layer. That is why, tarnished copper vessels are cleaned with lemon or tamarind juice to give the surface of the copper vessel its characteristic lustre.

**135. A man went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was upset but after a futile argument the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used?**

He must have dipped the gold bangles in the solution of aqua regia – a 3:1 mixture of conc. HCl and conc. $HNO_3$. Aqua regia is a fuming, highly corrosive liquid. It dissolves gold in it. After dipping the gold ornaments in aqua regia, the outer layer of gold gets dissolved and the inner shiny layer appears. That is why the weight of gold ornament reduced.

**136. Differentiate between metal and non-metal on the basis of their chemical properties.**

| Metals | Non-metals |
|---|---|
| Metals are electropositive | Non-metals are electronegative |
| They react with oxygen to form basic oxides. | They react with oxygen to form acidic or neutral oxides. |
| These have ionic bonds. | These have covalent bonds. |
| They react with water to form oxides and hydroxides. Some metals react with cold water, some with hot water, and some with steam. | They do not react with water. |
| They react with dilute acids to form a salt and evolve hydrogen gas. However, Cu, Ag, Au, Pt, Hg do not react. | They do not react with dilute acids. These are not capable of replacing hydrogen. |
| They react with the salt solution of metals. Depending on their reactivity, displacement reaction can occur. | These react with the salt solution of nonmetals. |
| They act as reducing agents (as they can easily lose electrons). | These act as oxidising agents (as they can gain electrons). |

**137. Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).**

Copper does not react with cold water, hot water, or steam. However, iron reacts with steam. If the hot water tanks are made of steel (an alloy of iron), then iron would react vigorously with the steam formed from hot water. That is why copper is used to make hot water tanks, and not steel.

$3Fe + 4H_2O \longrightarrow Fe_2O_3 + 4H_2$

**138. Give one word for the following:**

**a) Metal oxides which show basic as well as acidic behaviour.**

Amphoteric oxide

**b) Some metals produce a sound on striking a hard surface.**

Sonorous

**139. Give an example of each of the following:**

**a) A metal and a non-metal which are liquids at room temperature.**

Metal – Mercury, non-metal – Bromine

**b) A metal which is very soft and a non-metal which is very hard.**

Soft metal – Sodium, Hard non-metal - Diamond

**c) A metal which has very low melting point and a non-metal which has very high melting point**

Low melting point metal – Gallium, High melting point non-metal – Diamond

**d) A metal which reacts with hot water but not with cold water**

Iron

Fill in the blanks:

1) The easiest way to start grouping substances is by comparing their physical properties.
2) Metals have shining in their pure state.
3) The ability of metals to be beaten into thin sheets is called malleability.
4) The most malleable metals are gold and silver.
5) A metal which is not malleable is sodium.
6) The ability of metals to be drawn into thin wires is called ductility.
7) Metals can be given different shapes as they are malleable and ductile.
8) A metal which is used for making cooking vessels is Aluminium/ Copper/Iron.
9) The best conductors of heat are silver and copper.
10) A metal which is a poor conductor of heat is lead/mercury.
11) Metal oxides which react with both acids as well as bases to produce salts and water are known as amphoteric oxides.
12) An example of amphoteric oxide is aluminium oxide/zinc oxide.
13) The metals that do not react with oxygen are silver and gold.
14) The reagent that is able to dissolve gold and platinum is aqua regia.
15) The compounds formed by transfer of electrons from a metal to a non-metal are known as ionic compounds.
16) Ionic compounds are hard because of the strong force of attraction between the ions.
17) Electrovalent compounds are soluble in water.
18) Electrovalent compounds are insoluble in organic solvents.
19) Ionic compounds do not conduct electricity in solid state because of their rigid structure.
20) A major source of metals is earth's crust.
21) The elements or compounds, which occur naturally in the earth's crust, are known as minerals.
22) Minerals that contain a very high percentage of a particular metal which can be profitably extracted from it are called ores.
23) A metal found in free state is gold/silver/platinum/copper.
24) The metal that is found in free state as well as combined state is copper/silver.
25) The large amounts of impurities found with the ore is called gangue.
26) The ore of mercury is cinnabar.
27) The process in which sulphide ores are converted into oxides by heating them strongly in excess of air is known as roasting.
28) The process in which the carbonate ores are changed into oxides by heating strongly in limited air is called calcination.
29) The reducing agent used in the extraction of zinc is carbon.
30) The reducing agent used in the extraction of manganese is aluminium.
31) The element that cannot be used to reduce the oxide sodium is carbon.
32) Aluminium is obtained by the electrolytic reduction of aluminium oxide.
33) The most widely used method for refining impure metals is electrolytic refining.

34) The insoluble impurities that settle down at the bottom of the anode is called anode mud.

35) Silver reacts with sulphur in the air to form a coating of silver sulphide.

36) The method of protecting steel and iron from rusting by coating them with a thin layer of zinc is called galvanisation.

37) Iron can be made hard and strong by mixing with carbon.

38) Iron can be made rust free by mixing with nickel & chromium.

39) A homogeneous mixture of two or more metals, or a metal and a nonmetal is called alloy.

40) In India, gold used for making ornaments is 22 carat.

41) Pure gold is made hard by mixing with silver/copper.

Multiple Choice questions:

**1) Which of the following pairs will give displacement reactions?**

(a) NaCl solution and copper metal (b) $MgCl_2$ solution and aluminium metal

(c) $FeSO_4$ solution and silver metal **(d) $AgNO_3$ solution and copper metal.**

**2) Which of the following methods is suitable for preventing an iron frying pan from rusting?**

(a) Applying grease (b) Applying paint

**(c) Applying a coating of zinc** (d) all of the above.

**3) An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be**

**(a) calcium** (b) carbon (c) silicon (d) iron

**4) Food cans are coated with tin and not with zinc because**

(a) zinc is costlier than tin. (b) zinc has a higher melting point than tin.

**(c) zinc is more reactive than tin.** (d) zinc is less reactive than tin

**5) Which of the following property is generally not shown by metals?**

(a) Electrical conduction (b) Sonorous in nature

**(c) Dullness** (d) Ductility

**6) The ability of metals to be drawn into thin wire is known as:**

**(a) ductility** (b) malleability (c) sonorousity (d) conductivity

**7) Aluminium is used for making cooking utensils. Which of the following properties of aluminium are responsible for the same?**

(i) Good thermal conductivity (ii) Good electrical conductivity

(iii) Ductility (iv) High melting point

(a) (i) and (ii) (b) (i) and (iii) (c) (ii) and (iii) **(d) (i) and (iv)**

**8) Which one of the following metals do not react with cold as well as hot water?**

(a) Na (b) Ca (c) Mg **(d) Fe**

**9) Which of the following oxide(s) of iron would be obtained on prolonged reaction of iron with steam?**

(a) FeO (b) $Fe_2O_3$ **(c) $Fe_3O_4$** (d) $Fe_2O_3$ and $Fe_3O_4$

**10) What happens when calcium is treated with water?**

(i) It does not 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 (iii) (c) (i) and (ii) **(d) (iii) and (iv)**

**11) Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg)?**

(a) $H_2SO_4$ (b) HCl **(c) $HNO_3$** (d) All of these

**12) The composition of aqua-regia is:**

(a) Dil.HCl : Conc. $HNO_3$ 3 : 1 **(b) Conc.HCl : Dil. $HNO_3$ 3 : 1**

(c) Conc.HCl : Conc.$HNO_3$ 3 : 1 (d) Dil.HCl : Dil.$HNO_3$ 3 : 1

**13) Which of the following are not ionic compounds?**

(i) KCl (ii) HCl (iii) $CCl_4$ (iv) NaCl

(a) (i) and (ii) **(b) (ii) and (iii)** (c) (iii) and (iv) (d) (i) and (iii)

**14) Which one of the following properties is not generally exhibited by ionic compounds?**

(a) Solubility in water **(b) Electrical conductivity in solid state**

(c) High melting and boiling points (d) Electrical conductivity in molten state

**15) Which of the following metals exist in their native state in nature?**

(i) Cu (ii) Au (iii) Zn (iv) Ag

(a) (i) and (ii) (b) (ii) and (iii) **(c) (ii) and (iv)** (d) (iii) and (iv)

**16) Metals are refined by using different methods. Which of the following metals are refined by electrolytic refining?**

(i) Au (ii) Cu (iii) Na (iv) K

(a) (i) and (ii) (b) (i) and (iii) (c) (ii) and (iii) **(d) (iii) and (iv)**

**17) Silver articles become black on prolonged exposure to air. This is due to the formation of:**

(a) $Ag_3N$ (b) $Ag_2O$ **(c) $Ag_2S$** (d) $Ag_2S$ and $Ag_3N$

**18) Galvanisation is a method of protecting iron from rusting by coating with a thin layer of:**

(a) Gallium (b) Aluminium **(c) Zinc** (d) Silver

**19) Stainless steel is very useful material for our life. In stainless steel, iron is mixed with:**

**(a) Ni and Cr** (b) Cu and Cr (c) Ni and Cu (d) Cu and Au

**20) If copper is kept open in air, it slowly loses its shining brown surface and gains a green coating. It is due to the formation of:**

(a) $CuSO_4$ (b) $CuCO_3$ (c) $Cu(NO_3)_2$ **(d) CuO**

**21) Generally, metals are solid in nature. Which one of the following metals is found in liquid state at room temperature?**

(a) Na (b) Fe (c) Cr **(d) Hg**

**22) Which of the following metals are obtained by electrolysis of their chlorides in molten state?**

(i) Na (ii) Ca (iii) Fe (iv) Cu

(a) (i) and (iv) (b) (iii) and (iv) (c) (i) and (iii) **(d) (i) and (ii)**

**23) Generally, non-metals are not lustrous. Which of the following non-metal is lustrous?**

(a) Sulphur (b) Oxygen (c) Nitrogen **(d) Iodine**

**24) Which one of the following four metals would be displaced from the solution of its salts by other three metals?**

(a) Mg **(b) Ag** (c) Zn (d) Cu

**25) 2 mL each of concentrated HCl, HNO3 and a mixture of concentrated HCl and concentrated HNO3 in the ratio of 3 : 1 were taken in test tubes labelled as A, B and C. A small piece of metal was put in each test tube. No change occurred in test tubes A and B but the metal got dissolved in test tube C respectively. The metal could be**

(a) Al **(b) Au** (c) Cu (d) Pt

**26) An alloy is:**

(a) an element (b) a compound

**(c) a homogeneous mixture** (d) a heterogeneous mixture

**27) An electrolytic cell consists of:**

(i) positively charged cathode (ii) negatively charged anode

(iii) positively charged anode (iv) negatively charged cathode

(a) (i) and (ii) **(b) (iii) and (iv)** (c) (i) and (iii) (d) (ii) ad (iv)

**28) During electrolytic refining of zinc, it gets:**

**(a) deposited on cathode** (b) deposited on anode

(c) deposited on cathode as well as anode (d) remains in the solution

**29) An element A is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following:**

(a) Mg **(b) Na** (c) P (d) Ca

**30) Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents?**

(a) Brass (b) Bronze (c) Amalgam **(d) Steel**

**31) Which among the following statements is incorrect for magnesium metal?**

**(a) It burns in oxygen with a dazzling white flame**

(b) It reacts with cold water to form magnesium oxide and evolves hydrogen gas

(c) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas

(d) It reacts with steam to form magnesium hydroxide and evolves hydrogen gas

**32) Which among the following alloys contain mercury as one of its constituents?**

(a) Stainless steel (b) Alnico

(c) Solder **(d) Zinc amalgam**

**33) Reaction between X and Y, forms compound Z. X loses electron and Y gains electron. Which of the following properties is not shown by Z?**

(a) Has high melting point

**(b) Has low melting point**

(c) Conducts electricity in molten state

(d) Occurs as solid

**34) The electronic configurations of three elements X, Y and Z are X — 2, 8; Y — 2, 8, 7 and Z — 2, 8, 2. Which of the following is correct?**

(a) X is a metal (b) Y is a metal

(c) Z is a non-metal **(d) Y is a non-metal and Z is a metal**

**35) Although metals form basic oxides, which of the following metals form an amphoteric oxide?**

(a) Na (b) Ca **(c) Al** (d) Cu

**36) Generally, non-metals are not conductors of electricity. Which of the following is a good conductor of electricity?**

(a) Diamond **(b) Graphite** (c) Sulphur (d) Fullerene

**37) Electrical wires have a coating of an insulting material. The material, generally used is:**

(a) Sulphur (b) Graphite **(c) PVC** (d) All can be used

**38) Which of the following non-metals is a liquid?**

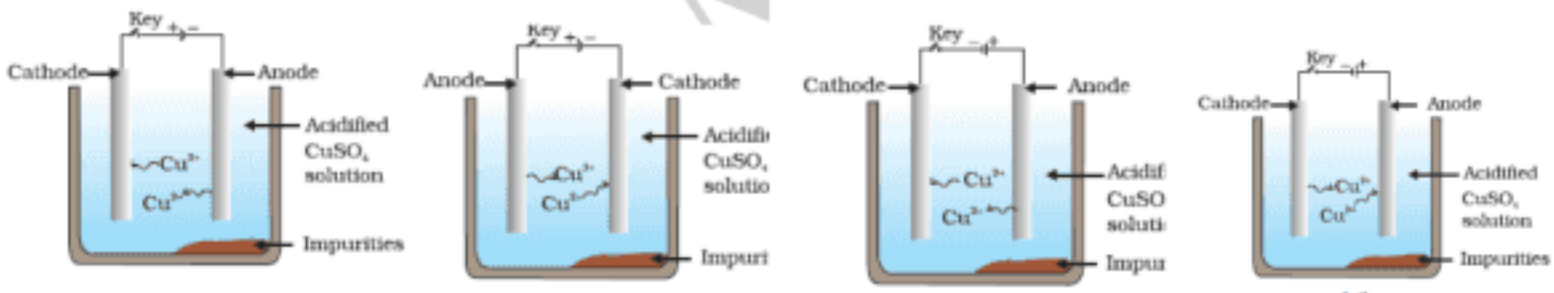
(a) Carbon **(b) Bromine** (c) Phosphorus (d) Sulphur

**39) Which of the following can undergo a chemical reaction?**

(a) $MgSO_4$ + Fe (b) $ZnSO_4$ + Fe

(c) $MgSO_4$ + Pb **(d) $CuSO_4$ + Fe**

**40) Which one of the following figures correctly describes the process of electrolytic refining?**




(a) a **(b) b** (c) c (d) d

**41) Goldsmith mix a small quantity of copper to pure gold to make it:**

(a) Attractive **(b) Hard** (c) Brittle (d) Soft

**42) When a small piece of sodium is dropped into water, the liberated gas which may catch fire is:**

**(a) Hydrogen** (b) oxygen (c) helium (d) nitrogen

**43) Iron exposed to air rusts rapidly in rainy season than in summer due to:**

(a) increase in temperature (b) low intensity of solar rays

**(c) increase in humidity** (d) change in pressure

**44) Which one of the following reactions does not produce hydrogen gas?**

(a) Sodium piece is added to water.

(b) dil. Hydro chloric acid is added to zinc

**(c) Conc. nitric acid is mixed to copper**

(d) steam is poured over hot iron.

**45) Which of the following elements gives its oxide quickly when kept in air?**

(a) magnesium (b) Iron **(c) sodium** (d) copper

**46) Which of the following is the correct arrangement in the purification of copper by electrolytic refining?**

(a) both cathode and anode are pure copper plates.

(b) only anode is made of pure copper.

(c) only cathode is an impure copper plate.

**(d) impure copper is anode and pure copper is cathode.**

**47) In the refining of copper, the mass of cathode:**

(a) decreases (b) increases

(c) decreases gradually (d) remains as before

**48) The most reactive metal among the following is:**

(a) zinc (b) Magnesium (c) Iron **(d) sodium**

**49) The metal which does not react with dilute hydrochloric acid is:**

(a) Zinc (b) magnesium **(c) platinum** (d) iron

**50) You are required to arrange Fe, Zn and Mg in the increasing order of their reactivity. The correct arrangement is:**

**(a) Mg, Zn, Fe** (b) Fe, Mg, Zn (c) Fe, Zn, Mg (d) Zn, Mg, Fe

**51) Heating of the ore in the absence of oxygen is called:**

**(a) Calcination** (b) Roasting (c) Froth floatation (d) Hydraulic washing

Match the following:

| **Column I** | **Column II** |
|---|---|
| Mercury | Calamine |
| Copper | |
| Zinc | Cinnabar |
| | Chalcocite |