

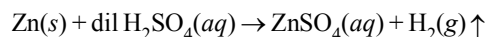
• **Metals and Non-Metals :** There are more than 114 elements present in the periodic table. These elements can be broadly classified into two categories i.e., metals and non-metals. Out of 114 elements, 22 are non-metals.

• **Physical properties of metals :**

- (i) They are usually shiny i.e. have a metallic luster.
- (ii) Metals have a high density
- (iii) Metals are ductile i.e. they can be drawn into wires.
- (iv) Metals are malleable i.e. they can be founded into thin sheets.
- (v) Metals are good conductors of electricity.
- (vi) Metals have high melting point and are generally in solid state at room temperature.
- (vii) Metals are good conductors of heat and sound.

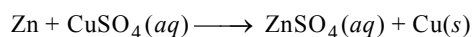
• **Chemical properties of metals :**

(i) **Reaction of metals with acids:** Metals can react with acid in a single displacement reaction to make hydrogen gas and an aqueous solution of a salt.



Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because  $\text{HNO}_3$  is a strong oxidising agent. It oxidises the  $\text{H}_2$  produced to water and itself gets reduced to any of the nitrogen oxides ( $\text{N}_2\text{O}$ ,  $\text{NO}$ ,  $\text{NO}_2$ ).

(ii) **Reaction of metal, with solutions of other metal salts:** Some metals are more reactive than others. Such metals can displace less reactive metals from their compounds in solution or molten form.



The relative electron releasing tendencies of some metals are summed up in the **Activity series** also called **Reactivity series**.

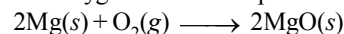
<b>K</b> = Potassium (Most reactive)	Most reactive ↓ Reactivity Decreases ↓ Least reactive
<b>Na</b> = Sodium	
<b>Ba</b> = Barium	
<b>Ca</b> = Calcium	
<b>Mg</b> = Magnesium	
<b>Al</b> = Aluminium	
<b>Zn</b> = Zinc	
<b>Cr</b> = Chromium	
<b>Fe</b> = Iron	
<b>Cd</b> = Cadmium	
<b>Co</b> = Cobalt	
<b>Ni</b> = Nickel	
<b>Sn</b> = Tin	
<b>Pb</b> = Lead	
<b>H</b> = Hydrogen	
<b>Cu</b> = Copper	
<b>Hg</b> = Mercury	
<b>Ag</b> = Silver	
<b>Au</b> = Gold	
<b>Pt</b> = (Platinum) (least reactive)	

Metals above hydrogen in the activity series give out hydrogen gas on reaction with a dilute acid such as  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$  etc. These are called **active metals**.

Metals placed below hydrogen in activity series do not evolve hydrogen on reaction with dilute acids. These are considered as **inactive metals**.

Metals like gold and platinum placed at the bottom of activity series are known as **Noble metals** and they are chemically very little reactive.

(iii) **Reaction with oxygen (formation of oxides) :** Many metals burn in the oxygen of the air to produce a metal oxide.



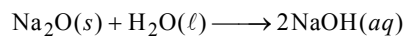
Many metals over a period of time tarnish in air. The metal slowly reacts with the oxygen of the air forming a dull layer of the metal oxide on the surface of the metal. The reactivity series :

K-Potassium Na-Sodium Ca-Calcium Mg-Magnesium	}	Burn very easily with a bright flame
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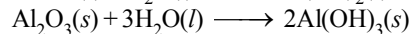
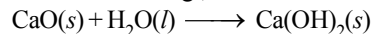
Al-Aluminium Zn-Zinc Fe-Iron Pb-Lead Cu-Copper	}	React slowly with air when heated
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Ag-Silver Au-Gold	}	No reaction
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(iv) **Action of metal oxide with water :** Oxides of some metals (i.e. Na, K, Mg etc.,) dissolve in water to yield soluble hydroxides known as **alkalies** e.g.



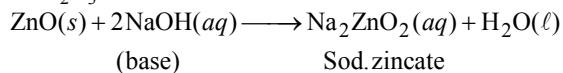
Oxides of same metals (e.g. Ca, Al etc.) do react with water but the corresponding hydroxides are not soluble in water. They remain as suspension. These hydroxides are known as **bases** e.g.,



(v) **Action of metal oxide with acids :** Metal oxides react with acids to form corresponding salts and water e.g.

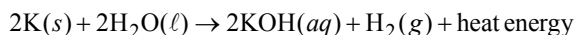


The oxides which exhibit the characteristics of both acids and bases are known as **amphoteric oxides** e.g.,  $\text{ZnO}$ ,  $\text{Al}_2\text{O}_3$  etc.

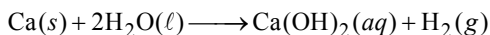


- (vi) **Reaction of metals with water** : Metals react with water and produce a metal oxide and hydrogen gas. Metal oxides that are soluble in water dissolve in it to further form metal hydroxide. But all metals do not react with water.

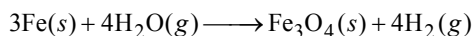
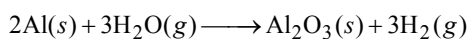
Metals like potassium and sodium react violently with cold water. In case of sodium and potassium, the reaction is so violent and exothermic that the evolved hydrogen immediately catches fire.



The reaction of calcium with water is less violent.



Metals like aluminium, iron and zinc do not react either with cold or hot water. But they react with steam to form the metal oxide and hydrogen.



• **Uses of Metals :**

- (i) Metals are very important for modern humans it is not possible to imagine our life without them.
- (ii) Metals are used in manufacturing of bridges, railways, aeroplanes, diesel mobile units (DMU), electric mobile units (EMU), motor cars, electric motors, telephones, televisions, interplanetary space vehicles, or even common articles like cooking utensils and coins.
- (iii) Metals are very important for the economy of a country. Some metals, such as titanium, chromium, manganese and zirconium are strategic metals. These metals and their alloys find wide applications in atomic energy, space science projects, jet engines and high grade steels.
- (iv) Gold and silver ornaments are obtained from small pieces of metals by hammering.

• **Noble metal** : Noble metals are metals that are resistant to corrosion or oxidation, unlike most base metals. Examples include tantalum, gold, platinum, and rhodium.

• **Precious metal** : A precious metal is a rare metallic chemical element of high economic value precious metals include the platinum group metals: ruthenium, rhodium, palladium, osmium, iridium, and platinum, of which platinum is the most widely traded.

• **Alloy** : An alloy is a mixture of two or more elements in solid solution in which the major component is a metal. Most pure metals are either too soft, brittle or chemically reactive for practical use. Combining different ratios of metals as alloys modify the properties of pure metals to produce desirable characteristics. The aim of making alloys is generally to make them less brittle, harder, resistant to corrosion, or have a more desirable color and luster. Examples of alloys are steel (iron and carbon), brass (copper and zinc), bronze (copper and tin), and duralumin (aluminium and copper).

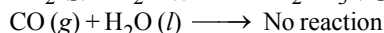
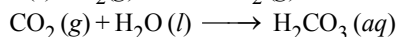
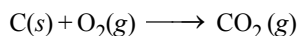
• **Physical properties of non-metals :**

- (i) They are dull, however diamond, graphite and iodine are lustrous.
- (ii) They are poor conductors of heat and electricity. Graphite is a good conductor.

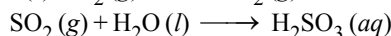
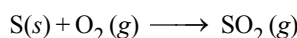
- (iii) They are weak and brittle (they easily break or shatter).
- (iv) They have a low density (they feel light for their size).
- (v) They do not make a ringing sound when they are hit.
- (vi) Melting points and boiling points are usually low.
- (vii) Non-metals are usually soft. (Diamond is an exception, it is quite hard. It is a crystalline solid).
- (viii) They exist in allotropic forms.

• **Chemical Properties of Non-Metals :**

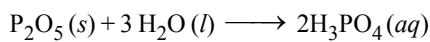
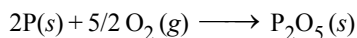
- (i) Non-metals react with oxygen to form either acidic or neutral oxides.
- (ii) Carbon reacts with oxygen to form carbon dioxide, which dissolves in water to form carbonic acid. Carbon reacts with insufficient amount of oxygen to form carbon monoxide, which is a neutral oxide and does not dissolve in water.



- (iii) Sulphur reacts with oxygen to form sulphur dioxide, an acidic oxide, which dissolves in water to form sulphurous acid.



- (iv) Phosphorus reacts with oxygen to form phosphorus pentoxide, an acidic oxide, which dissolves in water to form phosphoric acid.



- (v) Hydrogen reacts with oxygen to form water, which is a neutral oxide.
- (vi) Non-metals do not react with water.
- (vii) Non-metals do not replace hydrogen from acids.

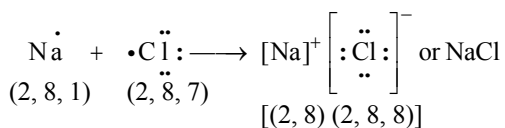
• **Uses of Non-Metals**

- (i) Oxygen is essential for survival of life.
- (ii) Hydrogen is used to convert vegetable oil into vegetable ghee by hydrogenation.
- (iii) Nitrogen is used to preserve food and for manufacturing proteins by plants.
- (iv) Carbon in the form of diamond is used for cutting rocks and in the form of graphite as electrode and in manufacturing of lead pencils.
- (v) Sulphur is used in vulcanization of rubber, as fungicide and in manufacture of dyes, gun powder etc.
- (vi) Chlorine is used as water disinfectant and in the manufacture of pesticides like gamma-xene.

• **Formation and Properties of Ionic Compounds**

In a metal and non-metal bond, the metal loses electrons to achieve a more stable electronic configuration, while the non-metal gains electrons. Thus an **ionic bond** is formed with transfer of electrons from metal to non-metal.

The compounds which contain ionic bonds are called **ionic compounds** or **electrovalent compounds** : e.g. NaCl (sodium chloride).



### Characteristics of Ionic Compounds :

- They conduct electricity in aqueous solution as well as in molten state.
- They have high melting points and boiling points.
- They are highly soluble in water and are insoluble in solvents such as benzene, ether, petrol, kerosene oil etc.
- They are crystalline solids and *hard* because of strong force of attraction between positive ions (cations) and negative ions (anions).
- These compounds are generally *brittle* and break into pieces when pressure is applied.

- Occurrence of metals :** Major source of metals is earth's crust but metals also exist in sea water as their soluble salts. Metals exist both in free state or native state (Au, Ag) and also in combined state (e.g., Na as NaCl, Fe as Fe<sub>2</sub>O<sub>3</sub>, Cu as Cu<sub>2</sub>S etc.)

- Minerals :** The inorganic elements or compound which occur naturally in earth's crust are called minerals.

- Ores :** Those minerals from which the metal can be extracted profitably and conveniently are called ores.

- Gangue or Matrix :** The unwanted impurities of sand and rocky materials present in the ore is known as gangue or matrix.

- Metallurgy :** It is the branch of science which deals with the extraction of metals from their ores, and then refining them for use.

- Various steps involved in metallurgy are :**

- Enrichment or concentration of ore
- Reduction
- Refining.

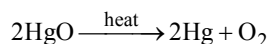
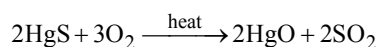
- Extraction of a Metal :**

Because of a difference in reactivities different techniques are used for extracting these three different categories of metals.

- Metals with low reactivity
- Metals with medium reactivity
- Metals with high reactivity.

- Extracting metals low in the activity series :** Metals that are low in the activity series are very un-reactive. The oxides of these metals can be reduced to metals by heating alone. For example, mercury is obtained from its ore, cinnabar (HgS), by the process of heating.

**Reduction using heat :**



- Extracting metals in the middle of the activity series:** Metals such as iron, zinc, lead, copper, etc., are in the middle of the reactivity series. These are moderately reactive metals and are usually present as sulphides or carbonates. A metal is obtained from its ore by the processes of reduction or by electrolysis. In the reduction process, it is the oxide ore that is reduced.

- Roasting :** Sulphide ores are converted into oxides by heating strongly in the presence of excess air, so that oxygen gets added to form the corresponding oxides. Sulphur impurities escape as gas.

- Calcination :** In Calcination process the ore is heated to a high temperature in the absence of air, or where air does not take part in the reaction. Usually, carbonate ores or ores containing water are calcined to drive out carbonate and moisture impurities.

- Thermite reaction :** A thermite reaction is basically iron oxide (rust) reacting with aluminium to produce molten iron. Here, iron oxide (Fe<sub>2</sub>O<sub>3</sub> = rust) and aluminum metal powder undergo a redox (reduction-oxidation) reaction to form iron metal and aluminum oxide (Al<sub>2</sub>O<sub>3</sub> = alumina):



This reaction is so exothermic that the iron is actually molten.

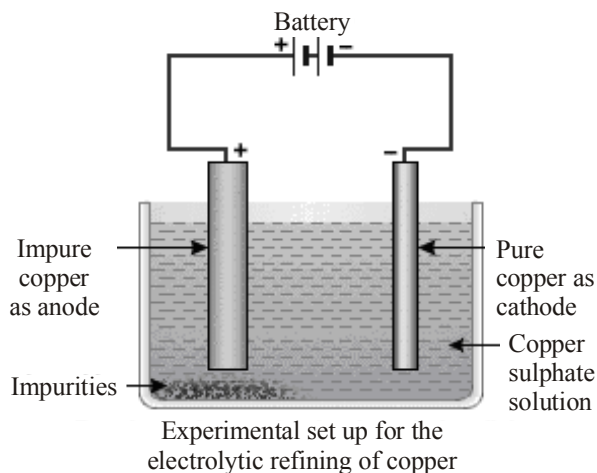
**Extracting metals towards the top of the activity series:** Metals such as sodium, magnesium, calcium, aluminium high up in the reactivity series are very reactive and cannot be obtained from their compounds by heating with carbon. This is because these metals have more affinity for oxygen than carbon. These metals are obtained by electrolytic reduction.

- Refining of the Metals :**

- By liquation :** This method is used for the easily fusible metals like tin etc. Impure metal is placed on the inclined bed of a furnace and heated. The metal melts and flows out leaving behind the impurities. E.g. purification of Sn containing impurities of high m.p. like Fe, Cu, W.

- By distillation :** Volatile metals like zinc and Hg etc. can be purified by this method. When these metals are heated their vapours are formed leaving behind the impurities. The vapours are condensed to get pure metals.

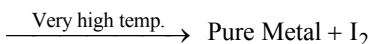
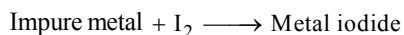
- Electrolytic refining :** The impure metal is taken as anode and the cathode consists of a pure metal. Cathodes and anodes are placed in a soluble salt of the metal taken as an electrolyte. Pure metal gradually passes on to the cathode and impurities either settles down or dissolved in the solution called anode mud. Large number of metals like copper, silver, gold and zinc are purified by this method. The metal of highest purity are obtained by this method.



(iv) **Thermal decomposition method** : In these methods, the metal is converted into suitable volatile compound which is decomposed at high temperature to give pure metal.

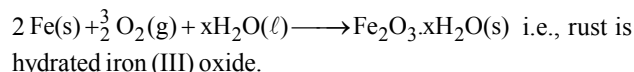
(a) **Mond's process or Carbonyl process (Purification of Ni)** : This method is used to purify nickel. Impure nickel is allowed to react with carbon monoxide at 60-80°C. It gives  $\text{Ni}(\text{CO})_4$ , which is a volatile compound. Vapours of  $\text{Ni}(\text{CO})_4$  decompose at about 180°C giving pure Ni ( $\approx 99.9\%$  purity).

(b) **Van-Arkel Process** : It is also known as iodine refining method. This method is used for obtaining metals of very high purity. Common metals which are refined by this method are Ti, Zr, Hf, Si etc. In this method metal is converted into a volatile compound (e.g., iodides) which is decomposed to obtain pure metal. Impurities are left behind as they do not react with  $\text{I}_2$ .



- Metalloids are those chemical elements that exhibit properties of both metals and non-metals. They behave as non-metals physically and chemically and show electrical conductivity like metals. However, they are not good conductors of electricity like metals and are known as semiconductors. There are seven metalloids in the periodic table that are placed in Group 13, 14, 15, 16 and 17. They form a zig zag step line in the periodic table.

- **Corrosion of Metals** : Corrosion is an oxidation reaction with atmospheric oxygen in the presence of water on the surface of a metal. Corrosion or rusting of iron is accelerated in the presence of  $\text{CO}_2$  and also in the presence of salt solution. Rusting is



The major problem of corrosion occurs with iron (or steel) as it is used as a structural material in industries like construction, infrastructure, bridges, rail transport, power transmission, ship building, automobiles, heavy industries etc. Lead corrodes to a white lead oxide or carbonate and copper corrodes to form a basic green carbonate (combination of the hydroxide  $\text{Cu}(\text{OH})_2$  and carbonate  $\text{CuCO}_3$ ).

- **Prevention of Rusting (Corrosion):**

- (i) Painting or applying a coat of grease on iron articles.
  - (ii) Galvanising iron articles. It is a process in which a layer of metals like chromium or zinc is deposited electrolytically on iron articles.
  - (iii) Electroplating the surface of iron articles with metals not attacked by atmospheric moisture.
  - (iv) **Alloying** : Iron or steel along with other metals can also be protected by 'alloying' or mixing with other metals (e.g., chromium) to make non-rusting alloys. Stainless steel is an example of a non-rusting alloy of iron and carbon.
- **Purity of Gold : 24-Carat gold** : The carat (abbreviation ct or Kt) is a measure of the purity of gold alloys. Carat is used to refer to the measure of mass for gemstones. As a measure of purity, one carat is purity by mass.

## Exercise

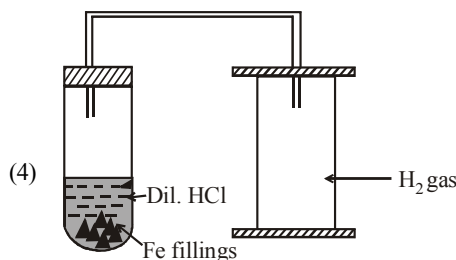
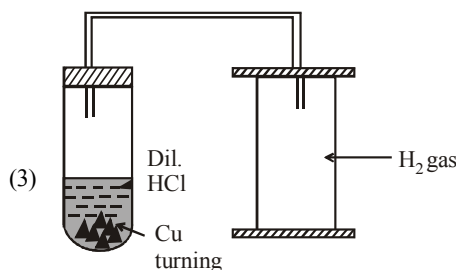
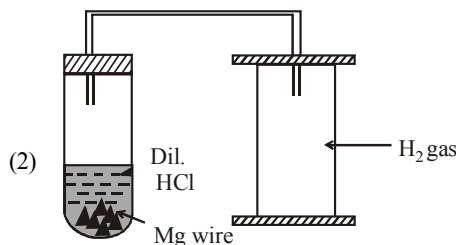
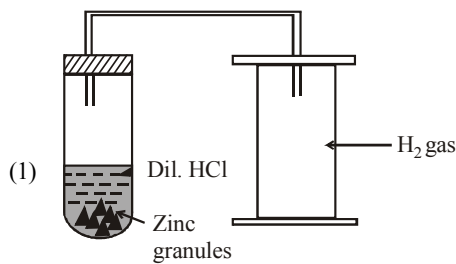
# 1

**DIRECTIONS** : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

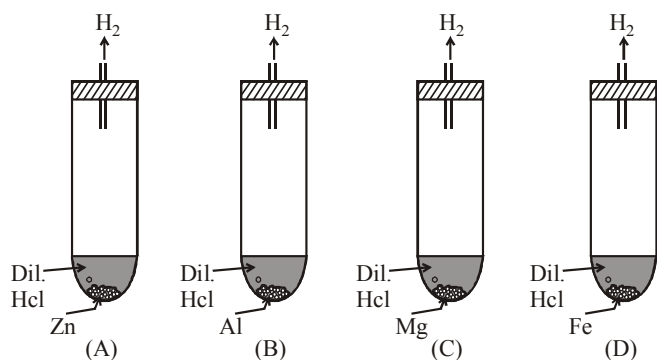
- Which of the following is liquid at ordinary temperature?
  - Germanium
  - Gallium
  - Gold
  - Galena
- The correct order of increasing chemical reactivity of following metals is -
  - $\text{Zn} < \text{Fe} < \text{Mg} < \text{K}$
  - $\text{Fe} < \text{Mg} < \text{Zn} < \text{K}$
  - $\text{Fe} < \text{Mg} < \text{K} < \text{Zn}$
  - $\text{Fe} < \text{Zn} < \text{Mg} < \text{K}$
- Metals generally are
  - reducing agents
  - oxidising agent
  - both oxidising and reducing agents
  - None of these
- The most abundant metal in the earth's crust is -
  - iron
  - copper
  - aluminium
  - mercury
- The metal that reacts with cold water is -
  - mercury
  - sodium
  - zinc
  - tungsten
- The only metal that is liquid at room temperature is -
  - mercury
  - sodium
  - zinc
  - tungsten
- Chemically rust is
  - hydrated ferric oxide only
  - hydrated ferrous oxide only
  - ferric oxide only
  - ferrous oxide only
- Alumina is chief ore of which of the following metal?
  - Na
  - K
  - Ca
  - Al
- Horn silver is
  - an oxide ore of silver
  - a sulphite ore of silver
  - a carbonate ore of silver
  - a chloride ore of silver
- Naturally occurring substances from which a metal can be profitably (or economically) extracted are called?
  - Minerals
  - Ores
  - Gangue
  - Salts
- Cinnabar is an ore of
  - Hg
  - Cu
  - Pb
  - Zn
- Which of the following is not an ore ?
  - Bauxite
  - Malachite
  - Zinc blende
  - Pig iron
- Which of the following mineral does not contain Al ?
  - Cryolite
  - Mica
  - Feldspar
  - Fluorspar

14. Formula of magnetite is  
 (1)  $\text{Fe}_2\text{O}_3$  (2)  $\text{FeS}_2$   
 (3)  $\text{FeCO}_3$  (4)  $\text{Fe}_3\text{O}_4$
15. Copper can be extracted from -  
 (1) kupfernickel (2) dolomite  
 (3) galena (4) malachite
16. Among the following statements, the incorrect one is -  
 (1) Calamite and siderite are carbonates  
 (2) Argentite and cuprite are oxides  
 (3) Zinc blende and pyrites are sulphides  
 (4) Malachite and azurite are ores of copper
17. Which ore contains both iron and copper?  
 (1) Cuprite (2) Chalcocite  
 (3) Chalcopyrite (4) Malachite
18. Calcination is the process of heating the ore  
 (1) in a blast furnace (2) in absence of air  
 (3) in presence of air (4) None of these
19. Of the following, which cannot be obtained by electrolysis of the aqueous solution of their salts.  
 (1) Ag (2) Mg and Al  
 (3) Cu (4) Cr
20. A student added zinc granules to copper sulphate solution taken in a test tube. Out of the following, the correct observation (s) made by of the student will be -  
 I. Zinc granules have no regular shape.  
 II. Zinc granules have silvery grey colour.  
 III. The colour of zinc granules changed to brownish black  
 (1) I only (2) II only  
 (3) III only (4) I, II and III
21. When sodium is exposed in air, what products will be formed  
 (1)  $\text{Na}_2\text{O}$  (2) NaOH  
 (3)  $\text{Na}_2\text{CO}_3$  (4) All of these
22. When a metal is added to dilute HCl solution, there is no evolution of gas. Metal is  
 (1) K (2) Na  
 (3) Ag (4) Zn
23.  $\text{Zn} + \text{H}_2\text{O} (\text{Steam}) \longrightarrow \text{A} + \text{B}$ ,  
 In the equation A and B are -  
 (1) Zn, H only (2)  $\text{ZnH}_2$  and  $\text{O}_2$   
 (3)  $\text{ZnO}_2$  &  $\text{O}_2$  (4) ZnO &  $\text{H}_2$
24. Which of the following is an oxide ore?  
 (1) Bauxite (2) Cuprite  
 (3) Haematite (4) All of these
25. Removal of impurities from ore is known as -  
 (1) crushing and grinding  
 (2) concentration of ore  
 (3) calcination  
 (4) roasting
26. Which reducing agent is used in chemical reduction?  
 (1) C (2) CO  
 (3) Al (4) All of these
27. Aluminium is used in thermite welding because -  
 (1) aluminium is a light metal  
 (2) aluminium has more affinity for oxygen  
 (3) aluminium is a strong oxidising agent  
 (4) aluminium is a reactive metal
28. The process of extraction of metal from its ores, is known as  
 (1) concentration (2) calcination  
 (3) purification (4) metallurgy
29. The process to heat the ore in the presence of excess supply of air below its melting point is called  
 (1) roasting (2) calcination  
 (3) smelting (4) liquation
30. Brass is a mixture of  
 (1) copper and zinc  
 (2) copper and tin  
 (3) copper, nickel and zinc  
 (4) aluminium, copper and traces of Mg and Mn
31. The white phosphorus is stored  
 (1) in air (2) under water  
 (3) under kerosene (4) under  $\text{CS}_2$
32. Aluminium is obtained from purified bauxite by  
 (1) electrolysis process  
 (2) strongly heating with coke  
 (3) strongly heating in a current of CO  
 (4) strongly heating in a current of  $\text{H}_2$
33. Sodium is obtained by the electrolysis of  
 (1) an aqueous solution of sodium chloride  
 (2) an aqueous solution of sodium hydroxide  
 (3) fused sodium chloride  
 (4) fused sodium sulphate
34. The chief ore of aluminium is  
 (1) bauxite (2) cryolite  
 (3) alunite (4) feldspar
35. One of the constituents of amalgam is  
 (1) aluminium (2) copper  
 (3) iron (4) mercury
36. Which of the following metals reacts with water/steam to produce oxide instead of hydroxide?  
 (1) Sodium (2) Potassium  
 (3) Calcium (4) Magnesium
37. Which of the following elements produces basic oxide on reacting with oxygen?  
 (1) Chlorine (2) Sulphur  
 (3) Phosphorus (4) Magnesium
38. Copper sulphate solution can be safely kept in a container made of  
 (1) aluminium (2) lead  
 (3) silver (4) zinc
39. Metal reacts with oxygen to form  
 (1) neutral oxides (2) basic oxides  
 (3) acidic oxides (4) None of these
40. The metal used to built bridges is  
 (1) gold (2) silver  
 (3) platinum (4) iron
41. Non-metallic oxide are  
 (1) acidic (2) basic  
 (3) neutral (4) (1) and (3)
42. Which of the following metals can displace hydrogen from acids?  
 (1) Silver (2) Mercury  
 (3) Magnesium (4) Copper
43. Which of the following is a good conductors of heat and electricity?  
 (1) Graphite (2) Oxygen  
 (3) Chlorine (4) Nitrogen
44. Metals are  
 (1) malleable (2) ductile  
 (3) Both (1) and (2) (4) Neither (1) nor (2)
45. Which of the following have low melting and boiling points?  
 (1) Phosphorus (2) Sodium  
 (3) Iron (4) (1) and (2)
46. Which of the following metal(s) catch fire on reaction with water?  
 (1) Sodium (2) Potassium  
 (3) Magnesium (4) (1) and (2)

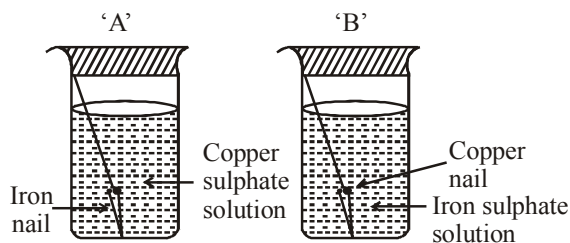
47. A metal, which forms a protective layer of its oxide on reaction with atmospheric oxygen, on its surface is  
 (1) sodium (2) aluminium  
 (3) potassium (4) magnesium
48. Which of the following non-metals has shining lustrous surfaces?  
 (1) Graphite and phosphorus  
 (2) Graphite and iodine  
 (3) Iodine and phosphorus  
 (4) Phosphorus and chlorine
49. Metals like Gold, Platinum which do not easily react are called  
 (1) active metals (2) dull metals  
 (3) noble metals (4) bright metals
50. The metalloids include the elements  
 (1) Boron, Silicon (2) Arsenic, Antimony  
 (3) Germanium, Tellurium (4) All the above
51. Select the one that could displace copper from a solution of copper sulphate.  
 (1) Silver (2) Mercury  
 (3) Tin (4) Gold
52. Select the property that is associated with non-metals.  
 (1) Low density  
 (2) Low melting point  
 (3) Poor conductor of electricity  
 (4) All of the above
53. Which of the following methods is suitable for preventing an iron frying pan from rusting?  
 (1) Applying grease  
 (2) Applying paint  
 (3) Applying a coating of zinc  
 (4) All of the above
54. Food cans are coated with tin and not with zinc because  
 (1) zinc is costlier than tin  
 (2) zinc has a higher melting point than tin  
 (3) zinc is more reactive than tin  
 (4) zinc is less reactive than tin
55. Which of the following non-metals sublimes on heating ?  
 (1) Fluorine (2) Chlorine  
 (3) Bromine (4) Iodine
56. Which of the following statement regarding metals is true?  
 (1) All metals are solid in nature.  
 (2) Metals can be used to make handle of cooking utensils  
 (3) Generally most of metals have high melting and boiling points.  
 (4) Gold is used generally to make electrical wires.
57. Which of the following statement regarding metals is false?  
 (1) Chief ore of aluminium is Bauxite.  
 (2) Chief ore of lead is Galena.  
 (3) Chief ore of mercury is Cassiterite.  
 (4) Chief ore of iron is Haematite.
58. Which of the following statement is false?  
 (1) Metals are good conductors of heat and electricity.  
 (2) Gold, Silver and Zinc are most malleable metals.  
 (3) Mercury is the only liquid metal.  
 (4) Bromine is the only liquid non-metal.
59. Which of the following statement is true?  
 (1) Silver can displace platinum from its salt solution.  
 (2) Aluminium can displace sodium from its salt solution.  
 (3) Mercury can displace copper from its salt solution.  
 (4) Silver can displace gold from its salt solution.
60. Which of the following statement regarding non-metals is true?  
 (1) Non-metals are of two types only solids and gases.  
 (2) Non-metals reacts with oxygen to form basic oxides generally.  
 (3) Non-metals are non-lustrous with dull appearance. Graphite, an allotrope of carbon and iodine have shining lustrous surfaces.  
 (4) Non-metals replace hydrogen from acids.
61. Which of the following statements regarding non-metals is false?  
 (1) 11 non-metals are in gaseous state.  
 (2) Gas carbon is a good conductor of heat and electricity.  
 (3) The black material inside a pencil is metal lead.  
 (4) All non-metals are non-sonorous in nature.
62. Four experimental set-up are shown below. A rapid evolution of  $H_2$  gas will be observed in which setup.



63. Observe the experimental setup carefully and give correct order of reactivity of these metals with dil HCl :



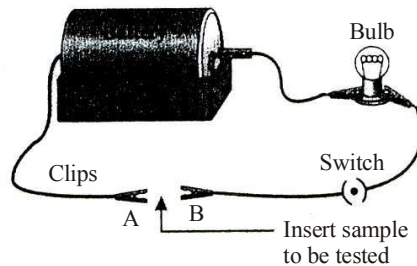
- (1)  $C > B > A > D$       (2)  $C > A > B > D$   
 (3)  $D > B > A > C$       (4)  $D > A > B > C$
64. Observe the following experimental set-up 'A' and 'B' carefully and answer in which beaker reaction will occur?



- (1) In beaker A  
 (2) In beaker B  
 (3) None of the two beakers  
 (4) Reaction occur in both beakers
65. Consider the following elements:  
 (i) Copper      (ii) Gold  
 (iii) Platinum      (iv) Silver  
 Which of the above elements exist free in nature?  
 (1) (i) and (ii)      (2) (ii) and (iii)  
 (3) (i), (ii) and (iv)      (4) (iii) and (iv)
66. Consider the following statements:  
 Nitrogen is an essential constituent of  
 (i) soils      (ii) animals  
 (iii) plants  
 Which of the statements given above is/are correct ?  
 (1) (iii) only      (2) (i) and (iii) only  
 (3) (i) and (ii) only      (4) (i), (ii) and (iii)
67. When iron is left exposed in open air, it gets rusted. Which constituent(s) of air is /are responsible for rusting iron?  
 (i) Oxygen gas present in air  
 (ii) Moisture present in air  
 (iii) Carbon dioxide gas present in air  
 Select the correct answer using the code given below :  
 (1) (i) only      (2) (ii) only  
 (3) (i) and (ii)      (4) (ii) and (iii)
68. 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

- (1) (i) and (ii)      (2) (i) and (iii)  
 (3) (ii) and (iii)      (4) (i) and (iv)
69. 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  
 (1) (i) and (iv)      (2) (ii) and (iii)  
 (3) (i) and (ii)      (4) (iii) and (iv)
70. 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) ?  
 (1)  $H_2SO_4$       (2) HCl  
 (3)  $HNO_3$       (4) All of these
71. Which of the following are not ionic compounds ?  
 (i) KCl      (ii) HCl  
 (iii)  $CCl_4$       (iv) NaCl  
 (1) (i) and (ii)      (2) (ii) and (iii)  
 (3) (iii) and (iv)      (4) (i) and (iii)
72. 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  
 (1) (i) and (ii)      (2) (i) and (iii)  
 (3) (ii) and (iii)      (4) (iii) and (iv)
73. Silver articles become black on prolonged exposure to air. This is due to the formation of  
 (1)  $Ag_3N$       (2)  $Ag_2O$   
 (3)  $Ag_2S$       (4)  $Ag_2S$  and  $Ag_3N$
74. Which of the following metals are obtained by electrolysis of their chlorides in molten state ?  
 (i) Na      (ii) Ca  
 (iii) Fe      (iv) Cu  
 (1) (i) and (iv)      (2) (iii) and (iv)  
 (3) (i) and (iii)      (4) (i) and (ii)
75. 2 mL each of concentrated HCl,  $HNO_3$  and a mixture concentrated HCl and concentrated  $HNO_3$  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  
 (1) Al      (2) Au  
 (3) Cu      (4) Pt
76. An electrolytic cell consists of  
 (i) positively charged cathode  
 (ii) negatively charged anode  
 (iii) positively charged anode  
 (iv) negatively charged cathode  
 (1) (i) and (ii)      (2) (iii) and (iv)  
 (3) (i) and (iii)      (4) (ii) and (iv)
77. 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 ?  
 (1) Has high melting point  
 (2) Has low melting point  
 (3) Conducts electricity in molten state  
 (4) Occurs as solid

78. Observe the experimental set up carefully



You are provided with four types of metallic wires i.e. silver wire, copper wire, lead wire and iron wire. Which type of metallic wire would you like to put in the circuit between gap of two terminals A and B, so that circuit show maximum conductivity.

- (1) Lead                      (2) Iron                      (3) Silver                      (4) Copper

79. Observe the following table of some metals and non-metals

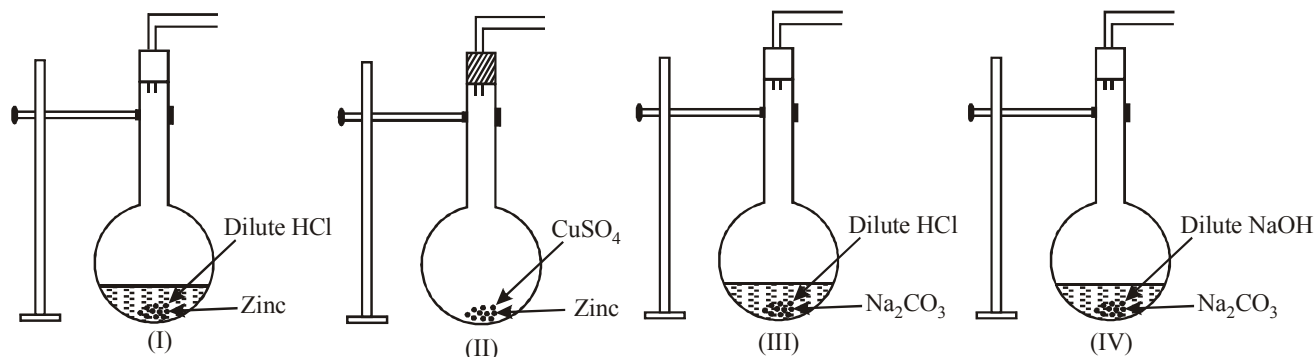
Metals	Symbol	Hardness	Malleability	Conductivity
P	Au	Very hard	Less	High
Q	Ag	Hard	Most	High
R	K	Soft	Very High	Less

Non-Metals	Symbol	Hardness	Malleability	Conductivity
X	S	Hard	No	Low
Y	I	Soft	Most	High
Z	C	Soft/Hard	No	Yes/No

Which pair is/are most correct in the tables given above?

- (1) P and X                      (2) R and Y                      (3) Q and Z                      (4) Q and Y

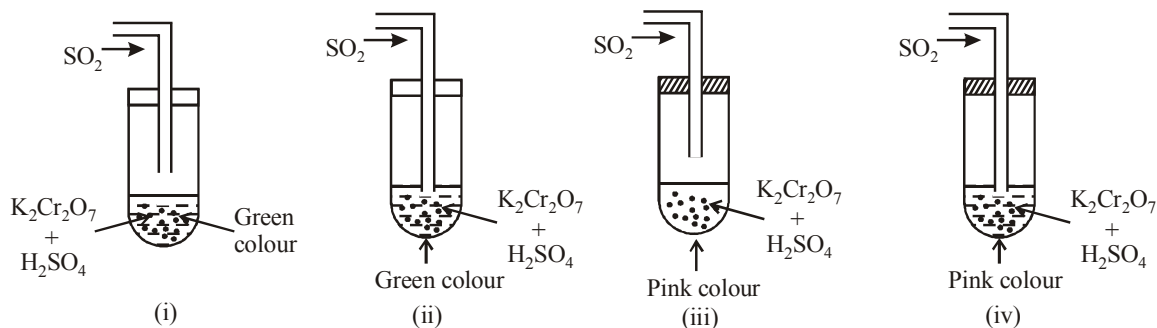
80. Observe following experimental setup carefully :



The setup that would result in a rapid evolution of gas would be

- (1) I and II                      (2) II and IV                      (3) I and III                      (4) III and IV

81. Observe following experimental setup carefully :



From the above observation which one is correct?

- (1) (i) only                      (2) (ii) only                      (3) (iii) only                      (4) (iv) only



82. Four students studied reactions of Zinc and  $\text{Na}_2\text{CO}_3$  with dil HCl and dil NaOH solution and presented their result as follows. The '✓' represents evolution of a gas where as 'x' represents no reaction.

	Zn	$\text{Na}_2\text{CO}_3$
HCl	✓	✓
NaOH	✓	x

(A)

	Zn	$\text{Na}_2\text{CO}_3$
HCl	✓	x
NaOH	✓	✓

(B)

	Zn	$\text{Na}_2\text{CO}_3$
HCl	x	x
NaOH	✓	✓

(C)

	Zn	$\text{Na}_2\text{CO}_3$
HCl	✓	✓
NaOH	x	x

(D)

The right set of observation is that of student

- (1) A (2) B (3) C (4) D

## Exercise

## 2

### Matching Based MCQ

**DIRECTIONS (Qs. 1 to 8) :** Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1. **Column-I (Ore)** **Column-II (Element)**

- (A) Ilmenite (p) Zinc  
 (B) Galena (q) Tungsten  
 (C) Sphalerite (r) Lead  
 (D) Scheelite (s) Titanium

(1) A – (s); B – (p); C – (r); D – (q)

(2) A – (q); B – (r); C – (p); D – (s)

(3) A – (s); B – (r); C – (p); D – (q)

(4) A – (q); B – (p); C – (r); D – (s)

2. **Column-I** **Column-II**

- (A) Iron (p) Cassiterite  
 (B) Aluminium (q) Galena  
 (C) Tin (r) Haematite  
 (D) Lead (s) Bauxite

(1) A – (r); B – (p); C – (s); D – (q)

(2) A – (q); B – (s); C – (p); D – (r)

(3) A – (s); B – (r); C – (p); D – (q)

(4) A – (r); B – (s); C – (p); D – (q)

3. **Column-I** **Column-II**

- (A) Malleable metal (p) Copper  
 (B) Low density metal (q) Mercury  
 (C) Metal used for making electrical wires (r) Silver  
 (D) Liquid metal (s) Sodium

(1) A – (q); B – (s); C – (p); D – (r)

(2) A – (r); B – (s); C – (p); D – (q)

(3) A – (s); B – (r); C – (p); D – (q)

(4) A – (r); B – (s); C – (q); D – (p)

4. **Column-I** **Column-II**

- (A) Manganese (VII) oxide (p) Basic oxide  
 (B) Aluminium oxide (q) Acidic oxide  
 (C) Sodium oxide (r) Neutral oxide  
 (D) Hydrogen oxide (s) Amphoteric oxide

(1) A – (s); B – (q); C – (p); D – (r)

(2) A – (q); B – (s); C – (p); D – (r)

(3) A – (q); B – (s); C – (r); D – (p)

(4) A – (r); B – (s); C – (p); D – (q)

5. **Column-I**

(A) Nitrogen

(B) Chlorine

(C) Oxygen

(D) Carbon

**Column-II**

(p) Non-metal necessary for life

(q) Non-metal used to preserve food

(r) Non-metal used for water disinfection

(s) Non-metal used in making lead pencil

(1) A – (s); B – (r); C – (p); D – (q)

(2) A – (q); B – (r); C – (p); D – (s)

(3) A – (r); B – (q); C – (p); D – (s)

(4) A – (q); B – (r); C – (s); D – (p)

6. **Column-I** **Column-II**

(A) Hardest Non-metal (p) Graphite

(B) Non-metal conducts electricity (q) Sulphur

(C) Non-metal with lustre (r) Diamond (Carbon)

(D) Non-metal used as fungicide (s) Iodine

(1) A – (r); B – (p); C – (s); D – (q)

(2) A – (q); B – (p); C – (s); D – (r)

(3) A – (p); B – (r); C – (s); D – (q)

(4) A – (r); B – (p); C – (q); D – (s)

7. **Column I** **Column II**

(A)  $\text{Fe} + \text{H}_2\text{SO}_4$  (p)  $\text{NaOH} + \text{H}_2$

(B)  $\text{Na} + \text{H}_2\text{O}$  (q)  $\text{CaCl}_2$

(C)  $\text{Ca} + \text{Cl}_2$  (r)  $\text{Mg}(\text{OH})_2 + \text{H}_2$

(D)  $\text{Mg} + \text{H}_2\text{O}$  (s)  $\text{Fe}_2(\text{SO}_4)_3 + \text{SO}_2 + \text{H}_2\text{O}$

(E)  $\text{Zn} + \text{O}_2$  (t)  $\text{ZnO}$

(1) A – (s); B – (q); C – (p); D – (r); E – (t)

(2) A – (s); B – (p); C – (q); D – (r); E – (t)

(3) A – (p); B – (s); C – (q); D – (r); E – (t)

(4) A – (s); B – (p); C – (q); D – (q); E – (t)

8. **Column I** **Column II**

(A) Brass (p) Homogeneous mixture of copper and zinc

(B) Bronze (q) Homogeneous mixture of iron and carbon

(C) Steel (r) Homogeneous mixture of copper and tin

(D) Solder (s) Homogeneous mixture of tin and lead

(E) German silver (t) Homogeneous mixture of copper, zinc and nickel.

- (1) A – (p); B – (r); C – (q); D – (t); E – (s)  
 (2) A – (p); B – (r); C – (s); D – (q); E – (t)  
 (3) A – (p); B – (r); C – (q); D – (s); E – (t)  
 (4) A – (r); B – (p); C – (q); D – (s); E – (t)

### Statement Based MCQ

9. Consider the following statements :
- (a) Metals can form positive ions by losing electrons to non-metals.  
 (b) Different metals have same reactivities with water and dilute acids.  
 (c) A more reactive metal displaces a less reactive metal from its salt solution.

Which of these statement(s) is/are correct?

- (1) (a) and (b)            (2) (a) and (c)  
 (3) (b) and (c)            (4) All are correct

10. Consider the following statements :
- (a) Non-metals have properties same to that of metals.  
 (b) In the activity series the elements Fe, Al, Zn are in the order  $Fe < Al < Zn$ .

Which of these statement(s) is/are correct?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

11. Consider the following statements :

- (a)  $Al_2O_3$  is a neutral oxide.  
 (b)  $N_2O$  is an acidic oxide.

Which of these statement(s) is/are correct ?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

12. Consider the following statements

- (a) A molecule of sulphur contains 4 sulphur atoms.  
 (b) Metals placed below hydrogen in activity series lose electrons to  $H^+$  ions of acids.  
 (c) Silver acquires a blackish tinge when exposed to air for a long time.

Which of these statement(s) is/are correct ?

- (1) (a) and (b)            (2) (a) and (c)  
 (3) (b) and (c)            (4) Only (c)

13. Consider the following statements :

- (a) Metals occur in nature only as free elements.  
 (b) Aluminium is the most abundant metal in the earth's crust.  
 (c) 24 carat gold is known as pure gold and is very soft.

Which of these statement(s) is/are correct?

- (1) (a) and (b)            (2) (a) and (c)  
 (3) (b) and (c)            (4) All are correct

14. Consider the following statements :

- (a) An alloy is a mixture of two or more metals  
 (b) An alloy is a mixture of a metals or metals with a non-metal.

Which of the statement(s) given above is/are correct ?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

15. Consider the following statements :
- (a) Roasting is done for sulphide ores  
 (b) Reaction takes place in aluminothermic process is also known as thermite reaction

Which of these statement(s) is/are correct ?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

16. Consider the following statements :

- (a) Mercury and zinc are purified by liquation method.  
 (b) The presence of carbon in pig iron makes it very soft and malleable.

Which of these statement(s) is/are correct ?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

17. Consider the following statements :

- (a) All ores contain minerals.  
 (b) Gangue are rocky materials present in ore.

Which of these statement(s) is/are correct ?

- (1) (a) only            (2) (b) only  
 (3) Both (a) and (b)    (4) Neither (a) nor (b)

18. Consider the following statements :

- (a) Solid NaCl conducts electricity.  
 (b) Bauxite is purified by chemical separation.  
 (c) Copper is purified by electrolytic refining.

Which of these statement(s) is/are correct ?

- (1) (a) and (b)            (2) (a) and (c)  
 (3) (b) and (c)            (4) All are correct

### Passage Based MCQ

**DIRECTIONS (Qs. 19 to 24) :** Read the passage(s) given below and answer the questions that follow.

#### PASSAGE - 1

Though most metals undergo similar kind of reactions. The “vigour” with which they react is not the same. Some are more reactive than the others. Metals along with hydrogen (a non-metal) are arranged in order of their reactivity in a series called activity series

Activity decrease	K
↓	Ca
	Na
	Mg
	Al
	Zn
	Fe
	H
	Cu
	Hg
	Ag
	Au

19. Which of the following is most reactive?

- (1) Sodium            (2) Potassium  
 (3) Calcium            (4) Magnesium

20. Which of the following can displace Iron from  $\text{FeSO}_4$  Solution?  
 (1) Zinc (2) Copper  
 (3) Silver (4) None of these
21. Which of the following will produce a colourless solution when dropped in copper sulphate solution?  
 (1) Magnesium (2) Iron  
 (3) Silver (4) None of these

### PASSAGE - 2

Reactive metals like sodium and potassium react with water with evolution of hydrogen gas and forming corresponding hydroxides where as the metals magnesium, zinc, aluminium and Iron are to low in reactivity to react with cold water but they will react with steam when red hot forming corresponding oxides.

22. Which of the following metal forms corresponding hydroxide on reaction with water?  
 (1) Mg (2) Na  
 (3) Fe (4) Zn
23. Which of the following metal do not react with cold water?  
 (1) Na (2) K  
 (3) Mg (4) Ca
24. Which of the following metal react with steam only?  
 (1) Na (2) Mg  
 (3) Al (4) Pt

### Assertion Reason Based MCQ

**DIRECTIONS (Qs. 25 to 30) :** Following questions consist of two statements, one labelled as the 'Assertion' and the other as 'Reason'. You are to examine these two statements carefully and select the answer to these items using the code given below.

**Code :**

- (1) Both A and R are individually true and R is the correct explanation of A:  
 (2) Both A and R are individually true but R is not the correct explanation of A.  
 (3) A is true but R is false  
 (4) A is false but R is true.

25. **Assertion :** Silver and gold are found in free state in nature.  
**Reason :** Silver and gold are noble metals.
26. **Assertion :** The elements sodium, potassium, aluminium are classified as metals because of their tendency to form cations.  
**Reason :** Metals are malleable, ductile and good conductors of heat and electricity.
27. **Assertion :** Zinc is used in galvanisation of iron  
**Reason :** Galvanisation increases the life of iron articles by protecting them from rusting.
28. **Assertion :** When a piece of aluminium is put in a solution of copper sulphate we get a colourless solution.  
**Reason :** Aluminium lies above copper in the activity series.
29. **Assertion :** Copper becomes dull in moist air.  
**Reason :** Copper is coated by a thin film of its basic carbonate and hydroxide in moist air.
30. **Assertion :** Rusting of iron does not take place in ordinary water.  
**Reason :** Ordinary water contains dissolved oxygen in it.

### Correct Definition Based MCQ

31. Which of the following is correct definition of Ores?  
 (1) Synthetic compounds of metals from which metals can be obtained economically.  
 (2) Naturally occurring compounds of metals from which metals can be obtained economically.  
 (3) Naturally occurring compounds of metals from which metals can be obtained in easiest way possible.  
 (4) Naturally occurring compounds of metals from which metals can be obtained in semipure state.
32. Which of the following is correct definition of reactivity series?  
 (1) It is the arrangement of metals in the order of decreasing reactivity.  
 (2) It is the arrangement of metals in the order of increasing reactivity.  
 (3) It is the arrangement of non-metals in the order of decreasing reactivity.  
 (4) It is the arrangement of non-metals in the order of increasing reactivity.
33. Which of the following is correct definition of minerals?  
 (1) The crystalline, inorganic constituent of rocks that make up the earth's crust.  
 (2) The crystalline, organic constituent of rocks that make up the earth's crust.  
 (3) The amorphous, inorganic constituents of rocks that make up the earth's crust.  
 (4) The amorphous, organic constituents of rocks that make up the earth's crust.
34. Which of the following is correct definition of stainless steel?  
 (1) It is an alloy of iron, carbon, nickel and chromium.  
 (2) It is an alloy of copper, carbon, nickel and chromium.  
 (3) It is an alloy of iron, carbon, manganese and chromium.  
 (4) It is an alloy of iron, carbon, nickel and Vanadium.

### Feature Based MCQ

35. On the basis of following features identify the correct metal.  
 (I) It is a metal with average density.  
 (II) This metal forms tough passive layer of oxide on its surface.  
 (III) It is the most abundant metal in earth crust.  
 (1) Na (2) Fe  
 (3) Cu (4) Al
36. On the basis of following features identify the correct metal.  
 (I) This metal is more reactive than iron and lead.  
 (II) This metal is used for galvanising of iron articles.  
 (III) This metal is non-malleable and brittle.  
 (1) Cr (2) Sn  
 (3) Au (4) Zn
37. On the basis of following features identify the correct non-metal.  
 (I) This is one of the crystalline forms of that non-metal  
 (II) It has a shining lustrous surface.  
 (III) It is a good conductor of heat and electricity.  
 (1) C (2) N  
 (3) S (4) H
38. On the basis of following features identify the correct non-metal.  
 (I) This non-metal is so soft that it can be cut with knife.  
 (II) This non-metal burn with oxygen to form acidic pentoxide.  
 (1) S (2) C  
 (3) P (4) H

## Exercise 1

- (2)
- (4) It is the correct order on the basis of reactivity series.
- (1) As metals are electropositive in nature and have tendency to lose electrons.
- (3)
- (2) It is because of extremely high reactivity of sodium.
- (1) Mercury is the only element even being metal is liquid at room temperature.
- (1) As the chemical formula of rust is  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
- (4)
- (4) Chemical formula of horn silver is  $\text{AgCl}$ .
- (2)
- (1) Cinnabar ( $\text{HgS}$ ) is a sulphide ore of mercury
- (4) Pig iron  $\rightarrow$  It is the most impure form of iron and contains highest proportion of carbon (2.5-4%). Rest all are ore.  
Malachite  $\rightarrow \text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$ ,  
Zinc blende  $\rightarrow \text{ZnS}$ ,  
Bauxite  $\rightarrow \text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
- (4) Fluorspar ( $\text{CaF}_2$ ), Cryolite ( $\text{Na}_3\text{AlF}_6$ ), Feldspar ( $\text{KAlSi}_3\text{O}_8$ ) and Mica ( $\text{K}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ )
- (4)
- (4) It is  $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$
- (2) Cuprite ( $\text{Cu}_2\text{O}$ ) and Argentite ( $\text{Ag}_2\text{S}$ )
- (3) Among cuprite [ $\text{Cu}_2\text{O}$ ], Chalcocite [ $\text{Cu}_2\text{S}$ ], Chalcopyrite [ $\text{CuFeS}_2$ ] and Malachite [ $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$ ], only Chalcopyrite is an ore which contains both Fe and Cu.
- (2)
- (2) Mg and Al cannot be obtained by the electrolysis of aqueous solution of their salts because instead of metal  $\text{H}_2$  gas is liberated at cathode.
- (3) The displacement reaction that occurs is  
$$\text{Zn}(s) + \text{CuSO}_4(aq) \rightarrow \text{ZnSO}_4(aq) + \text{Cu}(s)$$
  
(Brownish black)
- (4)
- (3) As silver is less reactive in nature it will not displace hydrogen from dilute acids.
- (4)
- (4)
- (4)
- (2)  $\text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \longrightarrow \text{Al}_2\text{O}_3(s) + 2\text{Fe}(l)$
- (4)
- (1)
- (1)
- (1)
- (2)
- (1)
- (3)
- (1) Bauxite is  $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ .
- (4)
- (4)
- (4) As magnesium is metal.
- (3)
- (2) Metals form basic oxides. For example oxide of calcium being basic is used to neutralise the acidity of soil.
- (4) Steel an alloy of iron and carbon is used for manufacturing bridges.
- (4) Non-metallic oxide could be acidic and neutral also. For example carbon dioxide ( $\text{CO}_2$ ) is acidic in nature whereas carbon monoxide ( $\text{CO}$ ) is neutral in nature.
- (3) Magnesium can displace hydrogen easily as it lie above hydrogen in activity series where as rest all three lie below hydrogen in reactivity series. Thus rest three elements will not able to displace hydrogen from acids.
- (1) Graphite is the only non-metal, which is a good conductor of heat and electricity.
- (3) Metals are both malleable and ductile. Metals can be drawn into thin sheets and wires.
- (4) Phosphorus is a non-metal and non-metals have low melting and boiling points. Although, sodium is a metal, it has low melting and boiling point.
- (4) Sodium and potassium both are extremely reactive and react with water so vigorously. This reaction is highly exothermic so that hydrogen evolved will catch fire.
- (2) Aluminium on reaction with atmospheric oxygen form a passive layer of  $\text{Al}_2\text{O}_3$  on its surface. This layer prevent metal from further oxidation.
- (2) Graphite which is crystalline form of carbon and iodine are the only two non-metals which has shining lustrous surfaces.
- (3) Noble metals are those metals which do not react easily and lie at the bottom of the activity series.
- (1) Both boron and silicon are metalloids.
- (3) Tin (Sn); [It lies above copper in Activity series]
- (4)
- (3)
- (3)
- (4)
- (3) Mercury being a metal is liquid at room temperature. Metals are good conductor of heat therefore cannot be used to make handle it will result into burns. Gold cannot be used to make electrical wires it is very expensive therefore metals like copper is used for it.
- (3) Chief ore of mercury is cinnabar.
- (2) Gold and Silver are most malleable metals whereas zinc metal is non-malleable and brittle.
- (4) As silver is above gold in reactivity series
- (3)
- (3) The black material inside a pencil is not metal lead. Actually it is graphite, a non-metal.
- (2) The most rapid evolution of  $\text{H}_2$  gas will takes place in experimental setup (2) because magnesium has highest reactivity toward dil HCl in comparison to zinc granules, copper turnings and iron fillings.
- (1)  $\text{C} > \text{B} > \text{A} > \text{D}$  is the correct order because this is the order of reactivity of these metals with dil HCl.
- (1) Reaction will occur in beaker A only because iron lie above copper in reactivity series thus being more active will displace copper from its salt.

65. (3) Cu, Au, Ag are known as coinage metals and occur free in nature. Because of nobility they are frequently found in their native state.
66. (3) Nitrogen is an essential constituent of all vegetables and animal proteins. Soil contains nitrogen as ammonium salts.
67. (3) Both oxygen and moisture present in air cause rusting of iron.
68. (4)                      69. (4)                      70. (3)
71. (2) HCl and CCl<sub>4</sub> are covalent compounds.
72. (1)                      73. (3)                      74. (4)
75. (2) Gold dissolves in Conc. HCl and Conc. HNO<sub>3</sub> 3 : 1 mixture (aqua regia)
76. (2)
77. (2) Z is ionic compound which has high melting point.
78. (3) Silver is a very good conductor of electricity.
79. (3)
80. (3)  $\text{Zn} + 2 \text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$   
 $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
81. (1)
82. (1)  $\text{Zn} + 2 \text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$   
 $\text{Na}_2\text{CO}_3 + 2 \text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$   
 $\text{Zn} + 2 \text{NaOH} + 2\text{H}_2\text{O} \longrightarrow \text{Na}_2[\text{Zn}(\text{OH})_4] + \text{H}_2$

### Exercise 2

1. (3)                      2. (3)                      3. (2)
4. (2) Generally oxides of metals are basic (Na<sub>2</sub>O) and oxides of non-metals are acidic (Mn<sub>2</sub>O<sub>7</sub>). Al<sub>2</sub>O<sub>3</sub> exhibits properties of both metal and non-metal oxides thus amphoteric in nature.
5. (2)                      6. (1)                      7. (2)
8. (3)                      9. (2)
10. (4) Non-metals have different properties as compared to metals. Correct order on the basis of reactivity series is Fe < Zn < Al.
11. (4)                      12. (4)                      13. (3)
14. (3) Metal-amalgams are also considered as alloys.
15. (3)
16. (3) Hg and Zn are purified by distillation. Presence of carbon in pig iron makes it hard.
17. (3)
18. (3) Solid NaCl cannot conduct electricity as it does not have free ions for electrolytic conductance.
19. (2)                      20. (1)
21. (1) Magnesium will displace copper from copper sulphate solution to form MgSO<sub>4</sub> which is a colourless solution. Thus blue colour of copper sulphate will change to colourless. Iron also displaces copper from copper sulphate but the color of iron sulphate formed is green. Silver can not displace copper.
22. (2) Sodium reacts with water thereby forming sodium hydroxide  
 $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \longrightarrow 2\text{NaOH}(aq) + \text{H}_2(g) \uparrow$
23. (3) Magnesium will not react with cold water it reacts with hot water by forming its oxide.
24. (3) Aluminium has low reactivity toward water. Thus reacts with steam only according to following equation.  
 $2\text{Al}(s) + 3\text{H}_2\text{O}(g) \longrightarrow \text{Al}_2\text{O}_3(s) + 3\text{H}_2(g) \uparrow$
25. (1) Noble metals are highly non-reactive metals. Noble metals can occur in free state.
26. (2)                      27. (1)
28. (1) Aluminium displaces copper from copper sulphate solution to form aluminium sulphate which is a colourless solution.
29. (1) Green coating of Cu(OH)<sub>2</sub>. CuCO<sub>3</sub> is formed on surface.
30. (4) Rusting of iron can take place in ordinary water. However, it is not possible in distilled water.
31. (2)                      32. (1)                      33. (1)
34. (1)                      35. (4)                      36. (4)
37. (1)                      38. (3)