

Metals and Non-metals

3

Basic Concepts

1. **Metals:** Metals are malleable, ductile and good conductor of heat and electricity. They possess high melting point and boiling point.

Examples: Cu, Al, Mg, Ag, Au, etc

Exceptions among metals:

- (a) All metals are solid but mercury is a liquid at room temperature.
- (b) Metals have high melting and boiling points, but gallium and caesium have very low melting points. These two metals will melt if you keep them on your palm.
- (c) Alkali metals (Li, Na, K) are soft and can be easily cut with a knife. They have low densities and low melting points.

2. **Non-metals:** Non-metals are non-malleable, non-ductile and bad conductor of heat and electricity. They possess low melting point and boiling point.

Examples: C, S, P, N, O, etc.

Exceptions among non-metals:

- (a) Non-metals are generally solids or gases except bromine which is liquid.
- (b) Iodine is a lustrous non-metal.
- (c) Diamond is the hardest natural known substance.
- (d) Graphite is a good conductor of electricity.

3. **Metalloids:** They show both characteristics, metallic as well as non-metallic.

Examples: Si, Ge, As, Sb and Te.

4. Differences between chemical properties of metals and non-metals:

Metals	Non-metals
<p>(i) Metals lose electrons and form +ve ions. $\text{Na} \rightarrow \text{Na}^+ + e^-$ Metals are electropositive elements.</p>	<p>(i) Non-metals gain electrons and form -ve ions. $\text{Cl} + e^- \rightarrow \text{Cl}^-$ Non-metals are electronegative elements.</p>
<p>(ii) Metals combine with oxygen and form basic oxides. $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$</p>	<p>(ii) Non-metals combine with oxygen and form acidic oxides or neutral oxides. $\text{C}(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g)$</p>
<p>(iii) Basic oxides + Water \rightarrow Bases $\text{Na}_2\text{O}(s) + \text{H}_2\text{O}(l) \rightarrow 2\text{NaOH}(aq)$ Sodium hydroxide In litmus test, the bases formed turn red litmus paper blue.</p>	<p>(iii) Acidic oxides + Water \rightarrow Acids $\text{CO}_2(g) + \text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{CO}_3(aq)$ Carbonic acid In litmus test, the acids formed turn blue litmus red.</p>

<p>(iv) (a) Oxidation: K and Na catch fire in oxygen. To prevent oxidation they are kept immersed in kerosene.</p> <p>(b) The surfaces of metals like Mg, Al, Zn, Pb, etc., are covered with a thin layer of their oxides. So, no further oxidation takes place.</p> <p>(c) Magnesium on heating burns forming magnesium oxide.</p> <p>(d) Copper on heating becomes coated with black coloured copper-oxide (CuO).</p> <p>(e) Silver and gold do not react with oxygen.</p>	<p>(iv) (a) CO₂ and SO₂ are acidic oxides (turn blue litmus red).</p> <p>(b) Carbon monoxide (CO), water (H₂O) and nitrous oxide (N₂O) are neutral oxides (no action on litmus).</p> <p>(c) A jet of hydrogen gas burns in air with a pale blue flame. Steam produced can be condensed to water.</p> $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
<p>(v) Reaction with Water:</p> <p>(a) Na and K react violently with cold water. Evolved H₂ gas catches fire.</p> $2\text{K}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{KOH}(\text{aq}) + \text{H}_2(\text{g})$ <p>2Na(s) + 2H₂O(l) → 2NaOH(aq) + H₂(g)</p> <p>(b) Magnesium reacts with hot water.</p> $\text{Mg}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Mg(OH)}_2(\text{aq}) + \text{H}_2(\text{g})$ <p style="text-align: center;">(Hot)</p> <p>(c) Al, Zn and Fe react with steam.</p> $2\text{Al}(\text{s}) + 3\text{H}_2\text{O}(\text{g}) \rightarrow \text{Al}_2\text{O}_3(\text{s}) + 3\text{H}_2(\text{g})$ $3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$ $\text{Zn}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{ZnO}(\text{s}) + \text{H}_2(\text{g})$ <p>(d) Lead(Pb), Copper(Cu), Silver(Ag) and Gold (Au) do not react with water.</p>	<p>(v) Non-metals do not react with water to evolve hydrogen gas.</p>
<p>(vi) Reactions with Acids:</p> <p>(a) Metals react with dil. HCl and H₂SO₄ to liberate H₂ gas.</p> <p>Metal + dil. Acid → Salt + Hydrogen</p> <p>(b) When metals react with dilute HNO₃, H₂ gas is not evolved but H₂O (water) is formed.</p> <p>Metal + dil. Nitric acid → Metal salt + Water + Oxides of nitrogen.</p> <p>(Exceptions: Mg and Mn evolve H₂ gas with dil. HNO₃)</p>	<p>(vi) Non-metals do not displace H₂ from acids because non-metals are electron acceptor, and they cannot supply electron to hydrogen.</p>
<p>(vii) Reaction with Chlorine:</p> <p>Metals react with Cl₂ to form ionic metal chloride.</p> <p>Metals are electron donor</p> <p>Chlorine is electron acceptor</p> $\text{Ca} \rightarrow \text{Ca}^{2+} + 2e^-$ $2\text{Cl} + 2e^- \rightarrow 2\text{Cl}^-$ $\text{Ca}^{2+} + 2\text{Cl}^- \rightarrow \text{CaCl}_2$	<p>(vii) Non-metals react with Cl₂ to form covalent chloride.</p> $\text{P}_4(\text{s}) + 6\text{Cl}_2(\text{g}) \rightarrow 4\text{PCl}_3(\text{g})$
<p>(viii) Reaction with Hydrogen:</p> <p>Hydrogen can share or lose electrons. But active metals like Na, K and Ca can force hydrogen atom to accept the electrons to form hydrides.</p> $2\text{Na}(\text{s}) + \text{H}_2(\text{g}) \rightarrow 2\text{NaH}(\text{s})$ $\text{Ca}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{CaH}_2(\text{s})$	<p>(viii) Hydrides of non-metals are stable compounds and are formed by sharing electrons.</p> $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ $\text{H}_2(\text{g}) + \text{S}(\text{s}) \rightarrow \text{H}_2\text{S}(\text{g})$

5. Ionic compounds: Ionic compounds are those compounds which are formed by the transfer of electrons from a metal to a non-metal. For example, NaCl.

Properties:

- (i) **Physical nature:** Ionic compounds are hard and solid due to strong force of attraction between oppositely charged ions.
- (ii) **Melting point and boiling point:** As more amount of energy is required to break strong bonds. So, they have high melting point and boiling point.
- (iii) **Solubility:** These are soluble in water (polar solvent) but insoluble in organic solvent.
- (iv) **Conduction of electricity:** They conduct electricity in solution or molten state as ions move towards opposite electrodes.

6. Occurrence of Metals

Minerals: The natural materials in which the metals occur in the form of its compounds.

Ores: Minerals from which metals can be extracted profitably and conveniently.

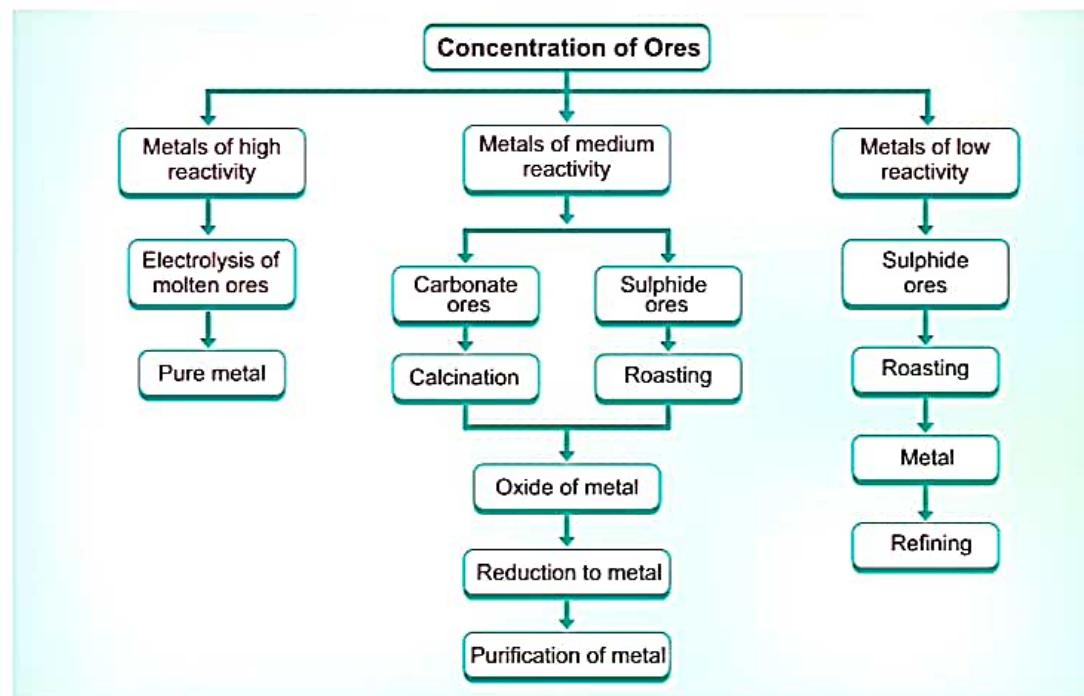
Gangue: The impurity present in the ore.

Reactivity series of metals: Depending upon the reactivity, the occurrence of metals in the activity series may be represented as shown below:

Top of the Series	K	Highly reactive metals are never found in free state.	Bottom of the series	Cu	Less reactive metals are found in free state as well as combined state.
	Na			Ag	
	Ca			Pt	
	Mg			Au	
	Al				
Middle of the series	Zn	Moderately reactive metals are found in the combined state.			Less reactive metals are found in free state.
	Fe				
	Pb				

Metallurgy: The extraction of metals from their ores and then refining them for use.

Steps involved in the extraction of metals from ores are described below:



Note: The oxide ores of metals of medium reactivity such as iron, is directly reduced to metal and then it is refined.

A.	Alloys of Iron: 1. Steel 2. Stainless steel	Iron, Carbon Iron, Nickel, Chromium	Hard, tough and strong. Used in construction of ships, bridges, vehicles, etc. Hard, does not rust. Used in surgical instruments, cutlery, utensils, etc.
B.	Alloys of Copper: 1. Brass 2. Bronze	Copper and Zinc Copper and Tin	Malleable, strong, resistant to corrosion. Used in screws, nuts, bolts, utensils, etc. Very strong, highly resistant to corrosion. Used for statues, coins, metals, ship propellers, etc.
C.	Solder	Lead and Tin	For welding electrical wires together.

8. **Amalgam:** If one of the metals is mercury in the mixture, then the alloy is known as amalgam.
9. **Carat:**
 - (i) Pure gold is 24 carat (very soft).
 - (ii) **22 carat gold:** It means 22 parts of pure gold is alloyed with 2 parts of either copper or silver.
10. **Noble metal:** Metals which do not corrode easily, are called noble metals. Examples: Silver, gold and platinum.
11. **Aqua regia:** It is a freshly prepared mixture of conc. HCl and conc. HNO_3 in the ratio of 3 : 1. Aqua regia can dissolve all metals, even gold and platinum also which cannot be dissolved by conc. HNO_3 or conc. HCl alone. But, the demerit of aqua regia is that it is highly corrosive and fuming liquid.

NCERT Intext Questions

Q. 1. Give an example of a metal which

- (i) is a liquid at room temperature;
- (ii) can be easily cut with a knife;
- (iii) is the best conductor of heat;
- (iv) is a poor conductor of heat.

[CBSE 2020 (31/2/2)]

[CBSE 2020 (31/2/2)]

Ans. (i) Mercury

(ii) Sodium/Potassium

(iii) Silver

(iv) Lead.

Q. 2. Explain the meanings of malleable and ductile.

Ans. Metals can be hammered into thin sheets. This property of metal is called malleability and the metals showing this property are called malleable. Gold, silver, copper, aluminium etc., are malleable metals.

Metals can be drawn into wires. The ability of metals to be drawn into thin wires is called ductility. Gold is the most ductile metal. It is interesting to know that a wire of about 2 km length can be drawn from one gram of gold.

Q. 3. Why is sodium kept immersed in kerosene oil?

Ans. Sodium is a very reactive metal. It reacts vigorously with the water and oxygen present in air and even catches fire. Hence, to protect sodium, it is kept immersed in kerosene oil.

Q. 4. Write equations for the reactions of

(i) iron with steam

(ii) calcium and potassium with water

Ans. (i) $3\text{Fe}(s) + 4\text{H}_2\text{O}(g) \longrightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$

(ii) $\text{Ca}(s) + 2\text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(aq) + \text{H}_2(g)$

$2\text{K}(s) + 2\text{H}_2\text{O}(l) \longrightarrow 2\text{KOH}(aq) + \text{H}_2(g)$

Q. 5. 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.

- Which is the most reactive metal?
- What would you observe, if B is added to a solution of copper(II) sulphate?
- Arrange the metals A, B, C and D in the order of decreasing reactivity.

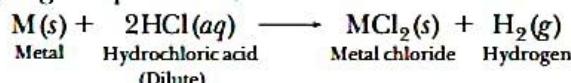
Ans. (i) B is most reactive.

(ii) B will displace copper from copper(II) sulphate.

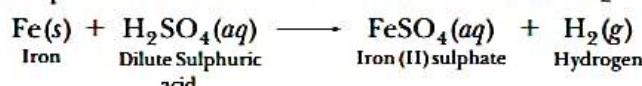
(iii) $B > A > C > D$.

Q. 6. 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 .

Ans. Hydrogen gas is produced, when a metal reacts with dilute hydrochloric acid.

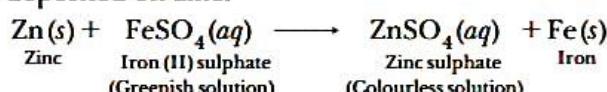


Chemical equation for the reaction of iron with dilute H_2SO_4 is



Q. 7. What would you observe, when zinc is added to a solution of iron(II)sulphate? Write the chemical reaction that takes place.

Ans. When zinc is added to a solution of iron(II)sulphate, the greenish colour of iron(II)sulphate solution fades away gradually, due to the formation of colourless zinc sulphate solution. Iron metal is deposited on zinc.



Q. 8. (i) Write the electron dot structures of sodium, oxygen and magnesium.

(ii) Show the formation of Na_2O and MgO by the transfer of electrons. [CBSE 2019 (31/3/2)]

(iii) What are the ions present in these compounds?

Ans. (i)

Metal	Symbol	Atomic Number	Electronic Configuration K, L, M, N	Number of Outermost Electrons	Electron dot structures
Sodium	Na	11	2, 8, 1	1	$\ddot{\text{N}}\text{a}$
Oxygen	O	8	2, 6	6	$\ddot{\text{:O}}$
Magnesium	Mg	12	2, 8, 2	2	Mg^+

(ii) Formation of Na_2O :

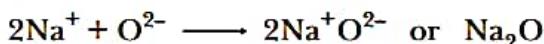
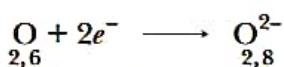
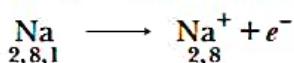
The atomic number of sodium is 11 and it has only one valence electron.

Hence, electronic configuration of $_{11}\text{Na}$ is $\begin{matrix} \text{K} & \text{L} & \text{M} \\ 2 & , 8 & , 1 \end{matrix}$.

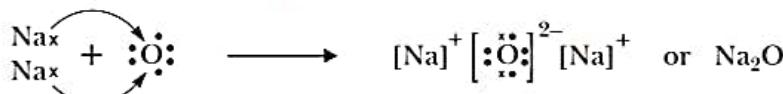
The atomic number of oxygen is 8 and it has 6 electrons in its valence shell.

Hence, electronic configuration of ${}_8\text{O}$ is $\begin{array}{c} \text{K L} \\ 2, 6 \end{array}$.

Sodium has a tendency to lose the valence electron and oxygen has a tendency to gain the electron lost by sodium. Since, sodium can lose only one electron of the valence shell and oxygen atom needs two electrons to complete its octet in the valence shell, two atoms of sodium combine with one atom of oxygen. By losing valence electron, sodium is changed into Na^+ cation and by gaining two electrons lost by two sodium atoms, oxygen atom is changed into an oxide anion, O^{2-} . In this process, both the atoms, sodium and oxygen, obtain the stable electronic configuration of the noble gas neon.



The oppositely charged sodium ion, Na^+ and oxide ion, O^{2-} are now held together by electrostatic forces of attraction or by ionic or electrovalent bond. Na_2O is, therefore, an ionic or electrovalent compound.

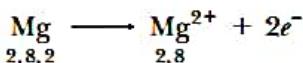


Formation of MgO :

The atomic number of magnesium = 12

Its electronic configuration is $\begin{array}{c} \text{K L M} \\ 2, 8, 2 \end{array}$

It has two electrons in its outermost shell. So, the magnesium atom donates its 2 valence electrons and forms a stable magnesium ion, Mg^{2+} , to attain the electronic arrangement of neon gas.



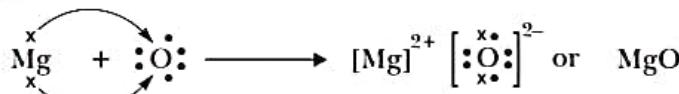
The atomic number of oxygen = 8

Electronic configuration = $\begin{array}{c} \text{K L} \\ 2, 6 \end{array}$

It has six electrons in its valence shell. Therefore, it requires two more electrons to attain the stable electronic arrangement of neon gas. Thus, oxygen accepts two electrons donated by magnesium atom and forms a stable oxide ion, O^{2-} .



The oppositely charged magnesium ions, Mg^{2+} and oxide ions, O^{2-} , are held together by a strong force of electrostatic attraction to form magnesium oxide compound $\text{Mg}^{2+}\text{O}^{2-}$ or MgO .



MgO is an ionic compound.

(iii) The ions present in Na_2O are sodium ions (2Na^+) and oxide ion O^{2-} .

The ions present in MgO are magnesium ion (Mg^{2+}) and oxide ion O^{2-} .

9. Why do ionic compounds have high melting points?

The ionic compounds are made up of positive and negative ions. There is a strong force of attraction between the oppositely charged ions. Therefore, a lot of energy is required to break this force of attraction and melt this ionic compound. That is why ionic compounds have high melting points.

10. Define the following terms:

(a) Mineral (b) Ore (c) Gangue

(a) **Mineral:** The inorganic element or compound, which occurs naturally in the earth's crust is called mineral. For example, copper pyrites (CuFeS_2), cuprite (Cu_2O), etc., are the minerals of copper.

(b) **Ore:** The mineral from which a metal can be extracted profitably and conveniently is called an ore. For example, bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$) and clay ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$) are the minerals of aluminium. But, extraction of aluminium is cheaper and easier from bauxite. Hence, bauxite is the ore of aluminium.

Thus, "every ore is a mineral but every mineral is not an ore."

(c) **Gangue or Matrix:** The unwanted impurities of sand and rocky materials present in the ore are known as gangue or matrix. We get a concentrated ore by removing the gangue present in it.

11. Name two metals, which are found in nature in the free state.

Gold and silver are least reactive and hence these metals occur in nature in the free state.

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

Reduction.

13. Metallic oxides of zinc, magnesium and copper were heated with the following metals:

Metal	Zinc	Magnesium	Copper
Zinc oxide			
Magnesium oxide			
Copper oxide			

In which cases will you find displacement reactions taking place?

As we know, a more reactive metal can displace a less reactive metal from its oxide. Here, magnesium is the most reactive, zinc is less reactive whereas copper is the least reactive metal. Thus, displacement reactions will take place in the following cases:

Metal	Zinc	Magnesium	Copper
Zinc oxide	—	Displacement	—
Magnesium oxide	—	—	—
Copper oxide	Displacement	Displacement	—

14. Which metals do not corrode easily?

Silver, gold, platinum and titanium.

15. What are alloys?

Alloys are homogeneous mixtures of two or more metals, or a metal and a non-metal. For example, brass is an alloy of two metals—copper and zinc, whereas steel is an alloy of a metal, iron and a small amount of a non-metal, carbon.

Q. 6. What are amphoteric oxides? Give two examples of amphoteric oxides. [CBSE 2019 (31/2/1)]

- Ans.**
- Metal oxides showing both acidic and basic nature ½
 - Example: $\text{Al}_2\text{O}_3/\text{ZnO}$ (or any other) ½
 - $\text{Al}_2\text{O}_3 + 6\text{HCl} \longrightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$ 1
 - $\text{Al}_2\text{O}_3 + 2\text{NaOH} \longrightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$ 1

(Or any other example of equations)
[CBSE Marking Scheme 2019 (31/2/1)]

Q. 7. Name two metals, which will displace hydrogen from dilute acids and two metals, which will not.

- Ans.**
- (i) Magnesium and zinc will displace hydrogen from dilute acids.
 - (ii) Copper and silver will not displace hydrogen from dilute acids.

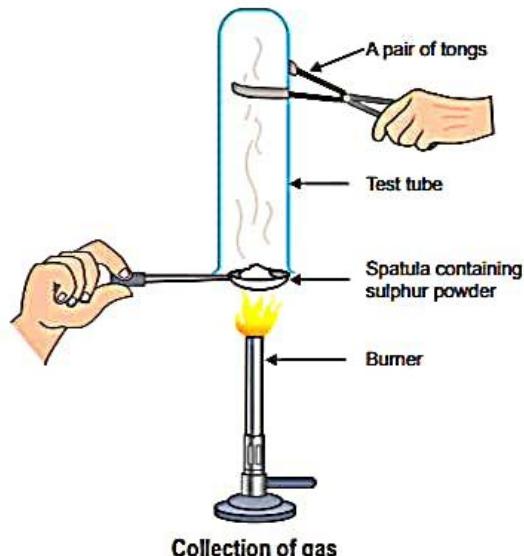
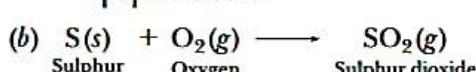
Q. 8. In the electrolytic refining of metal M, what would you take as the anode, the cathode and the electrolyte?

- Ans.**
- Anode: A thick block of impure metal M.
 - Cathode: A thin strip of the pure metal M.
 - Electrolyte: A water soluble salt of the metal M.

Q. 9. 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.

- Ans.**
- (a) When sulphur is heated in air, sulphur dioxide gas is formed.
 - (i) Sulphur dioxide has no action on dry litmus paper.
 - (ii) Sulphur dioxide turns moist blue litmus paper to red.



Q. 10. State two ways to prevent the rusting of iron.

- Ans.**
- (i) Galvanisation
 - (ii) Greasing

Q. 11. What type of oxides are formed, when non-metals combine with oxygen?

- Ans.** Non-metals react with oxygen to form acidic oxides or neutral oxides. Carbon forms an acidic oxide CO_2 , sulphur forms an acidic oxide SO_2 and hydrogen forms a neutral oxide H_2O . Carbon monoxide (CO), nitrous oxide (N_2O) and nitric oxide (NO) are also the examples of neutral oxides.

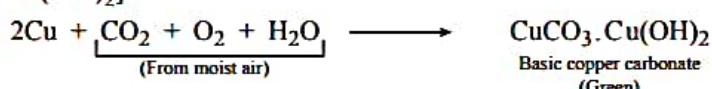
Q. 12. Give reasons:

- (a) Platinum, gold and silver are used to make jewellery. [CBSE 2019 (31/2/1)]
- (b) Sodium, potassium and lithium are stored under oil. [CBSE Sample Paper 2020; CBSE 2019 (31/2/1)]
- (c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking. [CBSE 2019 (31/2/1)]
- (d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction. [CBSE 2019 (31/2/1)]

- Ans.** (a) Lustre, ductile, malleable, least reactive (any two).
 (b) Na & K are highly reactive (in air & moisture)
 (c) Aluminium metal forms a thin layer of aluminium oxide all over its surface, under the action of moist air. This layer prevents the metal underneath from further corrosion. It is cheap, easily available, malleable, ductile and a good conductor of heat. Therefore, it is used to make utensils for cooking.
 (d) It is easier to obtain a metal from its oxides as compared to its sulphides and carbonates. So, prior to reduction, metal carbonate and sulphides must be converted into metal oxides. A carbonate ore is converted into oxide by calcination, whereas a sulphide ore is converted into oxide by roasting.

Q. 13. 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.

- Ans.** When copper vessels are exposed to moist air, they form a green coating of basic copper carbonate $[CuCO_3 \cdot Cu(OH)_2]$.



The sour substances such as lemon or tamarind juice contain acids. Lemon juice contains citric acid and tamarind contains tartaric acid. These acids dissolve the coating of copper oxide or basic copper carbonate, present on the surface of tarnished copper vessels and make them shining red brown again.

Q. 14. Differentiate between metals and non-metals on the basis of their chemical properties.

OR

List in tabular form three chemical properties on the basis of which we can differentiate between a metal and a non-metal. [CBSE 2019 (31/I/1)]

Ans.

Metals	Non-metals
1. Metals form basic oxides with oxygen 2. Metals react with dilute acids to liberate hydrogen 3. Metals form positively charged ions by losing electron	1. Non-metals form acidic or neutral oxides with oxygen 2. Non-metals do not displace hydrogen from dilute acids 3. Non-metals form negatively charged ions by gaining electrons

[CBSE Marking Scheme 2019 (31/I/1)]

Q. 15. 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?

- Ans.** The goldsmith dipped the set of the gold bangles in aqua regia solution. Aqua regia is a freshly prepared mixture of 1 part of conc. HNO_3 and 3 parts of conc. HCl by volume. Aqua regia dissolved a considerable amount of gold from the dipped gold bangles and hence reduced their weight drastically. The dishonest goldsmith can recover the dissolved gold from aqua regia by a suitable treatment.

Q. 16. Give reasons, why copper is used to make hot water tanks and not steel (an alloy of iron).

- Ans.** Copper is a much better conductor of heat than steel. Also, copper does not react with water at all but steel (an alloy of iron) reacts with steam. So, copper is used to make hot water tanks but not steel (an alloy of iron).

Multiple Choice Questions

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

A student performs some activities on two substances and records the observations in a table as shown.

Activity	Substance M	Substance N
Cut with a knife	Forms small pieces	Forms small pieces
Beaten with hammer	Shape changes	Changes into powder
Stricken with a metal rod	Makes a sound	Changes into powder

Which option classifies the substances into metals and non-metals? [CBSE Question Bank]

- (a) Both the substances are non-metals.
- (b) Both the substances are metals.
- (c) Substance M is metal while substance N is non-metal.
- (d) Substance M is non-metal while substance N is metal.

Shown below is a container that is used in the transportation of goods over long distances.



These containers are made of steel. Which property of steel is mainly used to make these containers? [CBSE Question Bank]

- (a) Its ductility
- (b) Its malleability
- (c) Its metallic lustre
- (d) Its electrical conductivity

Given below are reactions involving metals P, Q, R and S and their salt solutions in water. [Competency Based Question] [CBSE Question Bank]



Which metal is the MOST reactive?

- (a) P
- (b) Q
- (c) R
- (d) S

Na^+ has

- (a) 11 protons, 10 electrons
- (b) 10 protons, 11 electrons
- (c) 12 protons, 11 electrons
- (d) 11 protons, 12 electrons

Which of the following property is generally not shown by metals? [NCERT Exemplar]

- (a) Electrical conduction
- (b) Sonorous in nature
- (c) Dullness
- (d) Ductility

The ability of metals to be drawn into thin wire is known as

- (a) ductility
- (b) malleability
- (c) sonorosity
- (d) conductivity

[NCERT Exemplar]

What should be the next step in his representation of the ionic bond?

- (a) Transfer an electron from the calcium atom to the chlorine atom.
- (b) Transfer an electron from the chlorine atom to the calcium atom.
- (c) Add another chlorine atom to accept an electron from the calcium atom.
- (d) Add another calcium atom to donate an electron to the chlorine atom.

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

[NCERT Exemplar]

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

18. Which one of the following four metals would be displaced from the solution of its salts by other three metals?

[NCERT Exemplar][HOTS]

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

19. 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:

[NCERT Exemplar]

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

20. An electrolytic cell consists of:

[NCERT Exemplar]

- (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) and (iv)

21. The table lists the process which explains how pure metals are obtained from impure samples by electrolytic refining.

1. Keep impure metal at anode and pure metal at cathode.
2. Pass current in the electrolytic solution.
3. Insoluble impurities settle in the bottom of the anode as anode mud.
4. Pure metal from anode dissolves in the solution and pure metal from solution deposits on the cathode.

Which option range arranges the steps in the appropriate order?

[CBSE Question Bank]

- (a) 2-1-3-4
- (b) 1-2-4-3
- (c) 4-2-3-1
- (d) 3-1-4-2

22. Which among the following statements is incorrect for magnesium metal? [NCERT Exemplar]

- (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.

23. An element 'X' reacts with O₂ to give a compound with a high melting point. This compound is also soluble in water. The element 'X' is likely to be: [CBSE 2020 (31/I/2)]

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

24. Which among the following alloys contain mercury as one of its constituents?

[NCERT Exemplar]

- (a) Stainless steel
- (b) Alnico
- (c) Solder
- (d) Zinc amalgam

25. 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? [NCERT Exemplar]

- (a) Has high melting point
- (b) Has low melting point
- (c) Conducts electricity in molten state
- (d) Occurs as solid

Metal	Reaction with air	Reaction with water	Reaction with dilute acids
Gold	Does not oxidise or burn	No reaction	No reaction
Sodium	Burns vigorously to form oxide	Violent reaction	Violent reaction
Zinc	Burns to form oxides	Reacts on heating with water	Reacts to produce hydrogen
Platinum	Does not oxidise or burn	No reaction	No reaction

Which of the above metals are likely to be obtained in their pure states from the Earth's crust?

[Competency Based Question] [CBSE Question Bank]

Answers

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (c) | 2. (b) | 3. (c) | 4. (a) | 5. (c) | 6. (a) | 7. (d) |
| 8. (b) | 9. (d) | 10. (b) | 11. (c) | 12. (c) | 13. (a) | 14. (c) |
| 15. (b) | 16. (c) | 17. (d) | 18. (b) | 19. (b) | 20. (b) | 21. (b) |
| 22. (b) | 23. (b) | 24. (d) | 25. (b) | 26. (c) | 27. (b) | 28. (c) |
| 29. (c) | 30. (c) | | | | | |

Explanations of selected Multiple Choice Questions

- . (c) Q displaces P in equation 1, so Q is more reactive than P
R displaces Q in equation 2, so R is more reactive than Q
Q displaces S in equation 3, so Q is more reactive than S
S does not displace P in equation 4, so S is less reactive than P
So, the order of reactivity is S < P < Q < R
 - . (b) Metallic ash means oxide of a metal which is basic in nature. So, its basicity can be checked using a red litmus paper which will turn blue.
 - . (b) This is because Ag is least reactive among the four metals.
 - . (b) Z is an ionic compound. It has high melting point.

Passage-based/Case-based/Source-based Questions

Read the following passages and answer the questions that follow.

PASSAGE-1

Metals are elements that exhibit a variety of physical properties such as those of malleability, ductility, conductivity of heat and electricity, lustre, etc. Due to such properties, metals find usage in purpose such as cooking utensils, machinery, modes of transportation, construction, etc., in our daily life. Metals such as gold and silver have been used in making jewellery since ancient times. Non-metals have been found to exist in all the three states—solid, liquid and gaseous. They are non-malleable, non-ductile and are brittle in nature. Non-metals have very low tensile strength and are easily broken up.

- (i) Which of the following metal(s) will have very low melting point? 1
(a) Gallium (b) Caesium (c) Copper (d) Both (a) and (b)
- (ii) The metal which is known as strategic metal is 1
(a) zirconium (b) titanium (c) manganese (d) all of these
- (iii) Metals can be given different shapes according to our needs because 1
(a) they are malleable and ductile. (b) they are sonorous.
(c) they are generally hard. (d) they have a shining surface.
- (iv) Which of the following non-metal is a good conductor of electricity? 1
(a) Oxygen (b) Nitrogen (c) Graphite (d) Bromine

Ans. (i) (d); Metals generally have high melting and boiling points. For example, the melting point of copper is 1083°C . But, gallium and caesium have very low melting point, they will melt on keeping on hand.

(ii) (d); Some metals such as titanium, chromium, manganese, zirconium, etc., are classified as strategic metals. That is, they are essential for the country's economy and its defence. These metals and their alloys are used in atomic energy, space science projects, jet engines, etc.

(iii) (a); Metals can be given different shapes according to our needs because of their malleability and ductility.

(iv) (c); Except graphite (which is an allotropic form of carbon), all non-metals are bad conductors of heat and electricity. Since graphite is a good conductor of electricity, it is used for making electrodes.

PASSAGE-2

The properties of metals can be changed and improved by making alloys. Most alloys are mixtures of two or more metals, but in a few cases non-metals are also added. The usual way to make an alloy is to melt together the elements that make it up.

Pure aluminium is too soft for use as a car body or for aircraft manufacture. Mixing it with magnesium to make an alloy makes it stronger. The alloy of aluminium and magnesium is called magnalium. Steel are alloys in which the main metal element is iron. Mild steel is an alloy of iron and the non-metal carbon. It is harder and stronger than pure iron. Unfortunately, mild steel rusts easily. Stainless steel is much more rust-resistant. It is a an alloy of iron, chromium and nickel.

Source: Intermediate 1 Chemistry by Norman Conquest Page Nos. 72-73

- (i) Stainless steel is very useful material for our life. In stainless steel, iron is mixed with: 1
[NCERT Exemplar]

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

- (ii) 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? [NCERT Exemplar] 1
 (a) Brass (b) Bronze (c) Amalgam (d) Steel
- (iii) Name an alloy of aluminium used in the construction of aircraft. 1
 (a) Duralumin (b) Solder (c) Magnalium (d) Amalgam
- (iv) An alloy is: [NCERT Exemplar] 1
 (a) an element (b) a compound
 (c) a homogeneous mixture (d) a heterogeneous mixture
- Ans.** (i) (a); Besides iron and carbon, stainless steel contains about 18% chromium and 8% nickel.
 (ii) (d); Steel consists of 99% iron and 1% carbon.
 (iii) (a); Duralumin, an alloy of aluminium mixed with copper, magnesium and manganese is used in making aircraft structure and pressure cooker.
 (iv) (c); An alloy is a homogeneous mixture of two or more metals, or a metal and non-metal.

PASSAGE-3

All metals do not react with oxygen with the same speed. Different metals show different reactivity towards oxygen. For example, potassium and sodium react so vigorously that they catch fire even if kept in the open air. They are, therefore, kept under kerosene or paraffin oil. Metal oxides are solids. They are basic in nature. Metal oxides being basic turn red litmus to blue. Some metal oxides such as aluminium oxide, zinc oxide, etc., show both acidic as well as basic behaviour.

- (i) Name two metals that react violently with cold water. 1
 (ii) An element X forms an oxide X_2O_3 which is basic in nature. What type of element is 'X'? 1
 (iii) What happens to the red litmus when it is treated with the solution of ash obtained after burning magnesium ribbon in air? 2
- Ans.** (i) Metals like potassium and sodium react violently with cold water.
 (ii) Since element X forms an oxide which is basic in nature and therefore 'X' is a metal.
 (iii) When magnesium is heated, it burns with a dazzling white flame to form magnesium oxide. This metal oxide is basic in nature and thus turns red litmus to blue.

Very Short Answer Questions

Each of the following questions are of 1 mark and have to be answered in one word or one sentence.

- Q. 1. Name the following:**
 (i) Most malleable and ductile metal
 (ii) Non-metal that can exist in different forms [CBSE 2020 (31/2/2)]
- Ans.** (i) Gold (Au) $\frac{1}{2}$
 (ii) Carbon / Sulphur / Phosphorous $\frac{1}{2}$
- [CBSE Marking Scheme 2020 (31/2/2)]

- Q. 2. Name any two metals that have low densities.**

Ans. Lithium, sodium

- Q. 3. How can the pure iron which is very soft be made useful?**

Ans. Iron is mixed with about 0.05% carbon to make it hard and strong. Thus, it can be made useful.

- Q. 4. Why are metals good conductors of electricity?** [CBSE 2019 (31/1/1)]

Ans. Metals have loosely bound electrons / Loose electrons easily / free electrons 1
 [CBSE Marking Scheme 2019 (31/1/1)]

Q. 5. Which property of graphite is utilised in making electrodes?

Ans. Graphite is a good conductor of electricity. Due to this property, graphite is utilised in making electrodes.

Q. 6. Which of the following metals will melt at body temperature?

Gallium, Magnesium, Caesium, Aluminium

Ans. Gallium and caesium will melt at 37°C (body temperature).

Q. 7. Name two metals that do not react with water at all.

Ans. Lead and copper.

Q. 8. What happens when calcium is treated with water?

Ans. Calcium reacts less violently with water and bubbles of hydrogen gas stick to its surface.

Q. 9. Generally, non-metals are not lustrous. Name a non-metal which is lustrous.

Ans. Iodine

Q. 10. What is the nature of non-metal oxide?

Ans. Non-metal oxides are acidic or neutral in nature.

Q. 11. What is the nature of metal oxides?

Ans. Metal oxides are basic in nature.

Q. 12. Why does calcium float in water?

[CBSE Delhi 2011]

Ans. When calcium reacts with water, hydrogen gas is produced which sticks to the surface of calcium, so it floats in water.

Q. 13. What is flux?

Ans. Flux is a substance which is added to the ore, during reduction, for removing the non-fusible impurities.

Q. 14. Which oxide of iron could be obtained on prolonged reaction of iron with steam?

Ans. Fe_3O_4



Q. 15. Why are ionic compounds usually hard?

Ans. In all ionic compounds, their positive and negative ions are attached to each other by a strong ionic bond. So, they are rigid and hard solids.

Q. 16. Why does aluminium not react with water under ordinary conditions?

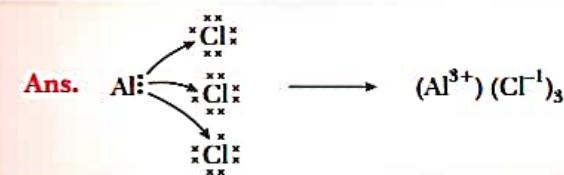
Ans. Aluminium does not react with water under ordinary conditions because of the presence of a thin layer of aluminium oxide on its surface.

Q. 17. In nature, metal A is found in a free state while metal B is found in the form of its compounds. Which of these two will be nearer to the top of the activity series of metals? [HOTS]

Ans. Metal B will be nearer to the top of the activity series of metals as it is so reactive that it is found in combined state.

Q. 18. Show the formation of aluminium ion and chloride ion by transfer of electrons.

[CBSE 2020 (31/2/3)]



1

[CBSE Marking Scheme 2020 (31/2/3)]

Q. 19. Arrange the following metals in decreasing order of their reactivity:

Fe, Zn, Na, Cu, Ag

Ans. $\text{Na} > \text{Zn} > \text{Fe} > \text{Cu} > \text{Ag}$.

Q. 3. A student added few pieces of aluminium metal to two test tubes A and B containing aqueous solutions of iron sulphate and copper sulphate. In the second part of her experiment, she added iron metal to another test tubes C and D containing aqueous solutions of aluminium sulphate and copper sulphate. In which test tube or test tubes will she observe colour change? On the basis of this experiment, state which one is the most reactive metal and why.

[CBSE 2018]

Ans.

$\text{Al(s)} + \text{FeSO}_4\text{(aq)} \rightarrow \text{Al}_2(\text{SO}_4)_3\text{(aq)} + \text{Fe(s)}$ <small>(green soln) (colourless)</small>	$\text{Al(s)} + \text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3\text{(aq)} + \text{Cu}$ <small>(blue soln) (colourless)</small>
<u>Test Tube C :-</u> $\text{Fe} + \text{Al}_2(\text{SO}_4)_3 \rightarrow \text{No reaction}$	
<u>Test Tube D :-</u> $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{Cu}$ <small>(blue soln) (pale green soln)</small> So, colour changed in Test Tube A, B, D.	
<u>Reactivity :-</u> $\text{Al} > \text{Fe} > \text{Cu}$	[Topper's Answer 2018]

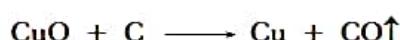
Q. 4. There are 3 unknown metals—A, B and C. C displaces B from its oxide while with oxide of A, there is no reaction. Give the reactivity order of A, B and C. [HOTS]

Ans. C displaces B from its oxide, therefore, C is more reactive than B.

There is no reaction when C is treated with oxide of A or C does not displace A from its oxide. So, A is more reactive than C. Thus, the reactivity order is B < C < A.

Q. 5. Carbon can reduce copper oxide to copper but not CaO to Ca. Why? [HOTS]

Ans. C is a strong reducing agent and can reduce CuO as follows:



Ca is much more reactive than Cu and has greater affinity for oxygen than C. So, carbon cannot reduce CaO to Ca.

Q. 6. The following reaction takes place when aluminium powder is heated with MnO_2 .



(i) Is aluminium getting reduced?

(ii) Is MnO_2 getting oxidised?

[NCERT Exemplar]

Ans. (i) No, because oxygen is added to aluminium therefore, it is getting oxidised.

(ii) No, since manganese has lost oxygen therefore, it is getting reduced.

Q. 7. A solution of CuSO_4 was kept in an iron pot. After few days the iron pot was found to have a number of holes in it. Explain the reason in terms of reactivity. Write the equation of the reaction involved. [NCERT Exemplar]

Ans. Iron is more reactive than copper. Hence, when a solution of CuSO_4 is kept in an iron pot, iron slowly displaces copper from the solution and blue colour of the solution keeps fading away. Because of iron going into solution as iron sulphate, a number of holes are seen in the iron pot. The reaction is

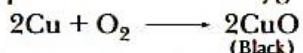


Q. 8. Generally, when metals are treated with mineral acids, hydrogen gas is liberated but when metals (except Mn and Mg) are treated with HNO_3 , hydrogen is not liberated, why? [NCERT Exemplar]

Ans. It is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to H_2O and itself get reduced to any of the oxides of the nitrogen, like NO_2 , NO , etc.

Q. 9. A metal M does not liberate hydrogen from acids but reacts with oxygen to give a black colour product. Identify M and black coloured product and also explain the reaction of M with oxygen. [NCERT Exemplar]

Ans. M is copper. It reacts with oxygen to form black coloured compound, CuO .



Q. 10. The following observations were made by a student on treating four metals P, Q, R and S with the given salt solutions: [Competency Based Question] [CBSE Sample Paper 2021]

Sample	$\text{MgSO}_4(\text{aq})$	$\text{Zn}(\text{NO}_3)_2(\text{aq})$	$\text{CaSO}_4(\text{aq})$	$\text{Na}_2\text{SO}_4(\text{aq})$
P	No reaction	Reaction occurs	Reaction occurs	No reaction
Q	Reaction occurs	Reaction occurs	Reaction occurs	Reaction occurs
R	No reaction	Reaction occurs	No reaction	No reaction
S	No reaction	No reaction	No reaction	No reaction

Based on the above observations:

(a) Arrange the given samples in the increasing order of reactivity.

(b) Write the chemical formulae of products formed when Q reacts with CuSO_4 solution.

Ans. (a) $S < R < P < Q$

(b) From the table, it is clear that Q is most reactive element. So, when it reacts with CuSO_4 , it displaces Cu and the products are Cu and QSO_4 .

Q. 11. State the reason for the following behaviour of zinc metal:

On placing a piece of zinc metal in a solution of mercuric chloride, it acquires a shining silvery surface but when it is placed in a solution of magnesium sulphate no change is observed.

Ans. When a piece of zinc metal is placed in a solution of mercuric chloride (HgCl_2), a white layer of mercury is deposited on zinc metal to give it silvery shining look. This is because mercury is lower to zinc in reactivity series and hence, zinc can displace mercury from HgCl_2 .

But when zinc is placed in a solution of magnesium sulphate, there is no change. This is because magnesium is above zinc in the reactivity series and hence, zinc cannot displace magnesium from its salt solution.

Q. 12. What happens when:

(i) ZnCO_3 is heated in the absence of oxygen?

(ii) a mixture of Cu_2O and Cu_2S is heated?

[NCERT Exemplar]

Ans. (i) It undergoes calcination. The chemical reaction can be given as:



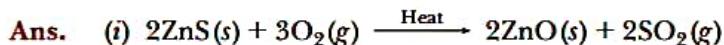
(ii) It undergoes auto reduction forming copper and sulphur dioxide.



Q. 13. Give the reaction involved during extraction of zinc from its ore by:

- (i) roasting of zinc ore
- (ii) calcination of zinc ore

[NCERT Exemplar]



Q. 14. What is 24-carat gold? How will you convert it into 18-carat gold?

Ans. 24-carat gold is pure gold. Pure gold is very soft and not suitable for making jewellery.

Therefore, to increase its hardness, it is alloyed either with copper or silver.

18-carat gold is prepared by alloying 18 parts pure gold with 6 parts of either copper or silver.

Q. 15. What would happen to iron railings on the road side if they are not painted? Why does it happen so?

Ans. If the iron railing on the road side is not painted, a brown rust would form on its surface because the moist air of the atmosphere reacts with iron to form brown flaky substance on its surface. The rust is hydrated iron (III) oxide, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$.

Q. 16. Explain why, the galvanised iron article is protected against rusting even if the zinc layer is broken.

Ans. The galvanised iron article is protected against rusting even if the zinc layer is broken because zinc is more easily oxidised than iron. So when zinc layer on the surface of galvanised iron article is broken, then zinc continues to corrode but iron article does not corrode or rust.

Q. 17. Why are food cans tin-plated instead of zinc plated though zinc is cheaper than tin?

Ans. Tin is less reactive than zinc. It is less likely to dissolve in the liquid stored in the food cans. Tin reacts only with powerful acids whereas zinc can easily react even with tomatoes, so it is not safe to store food in zinc-plated cans.

Q. 18. Silver articles become black when kept in open for some time, whereas copper vessels lose their shiny brown surfaces and gain a green coat when kept in open. Name the substances present in air with which these metals react and write the name of the products formed.

[Competency Based Question] [CBSE 2019 (31/2/1)]

Ans.		Product	
	Silver	Sulphur in air	$\frac{1}{2} + \frac{1}{2}$
	Copper	Moisture & Carbon dioxide	$\frac{1}{2} + \frac{1}{2}$

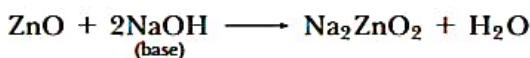
[CBSE Marking Scheme 2019 (31/2/1)]

Short Answer Questions-II

Each of the following questions are of 3 marks and have to be answered in about 50-80 words.

Q. 1. 'X' is an amphoteric oxide. It is reduced to metal by using suitable reducing agents such as carbon. Identify 'X'. Write its reaction with acid as well as base.

Ans. 'X' is Zinc oxide (ZnO).



Q. 2. A metal 'X' when added to a solution containing $ZnSO_4$ shows no change in the colour of the solution. The metal 'X' is also used to join railway tracks.

- Identify the metal 'X'.
- What is the other reactant used in the reaction with 'X' to join railway tracks?
- Name the method to extract the metal 'X'.

Ans. (i) 'X' is aluminium.

(ii) Fe_2O_3

(iii) Electrolytic reduction.

Q. 3. (i) Give two examples each of the metals that are good conductors and poor conductors of heat respectively.

(ii) Name one metal and one non-metal that exist in liquid state at room temperature. Also name two metals having melting point less than 310 K ($37^\circ C$). [NCERT Exemplar]

Ans. (i) (a) Good conductors: Ag and Cu

(b) Poor conductors: Pb and Hg

(ii) Metal: Mercury (Hg); Non-metal: Bromine (Br)

Two metals with melting points less than 310K are Cesium (Cs) and Gallium (Ga).

Q. 4. Name the constituents of the following alloys :

- (i) Brass (ii) Stainless steel (iii) Bronze

State one property in each of these alloys which is different from its constituents.

[CBSE 2020 (31/4/3)]

Ans. (i) Copper and Zinc/Cu and Zn

½

(ii) Iron, Nickel and Chromium/Fe, Ni, Cr

½

(iii) Copper and Tin/Cu and Sn.

½

● Brass and Bronze have lower electrical conductivity than their constituents.

½+½

● Stainless steel does not corrode easily as iron does.

½

[CBSE Marking Scheme 2020 (31/4/3)]

Q. 5. (i) Name a metal for each case:

(a) It does not react with cold as well as hot water but reacts with steam.

(b) It does not react with any physical state of water.

(ii) When calcium metal is added to water the gas evolved does not catch fire but the same gas evolved on adding sodium metal to water catches fire. Why is it so?

Ans. (i) (a) Aluminium, (b) Copper

(ii) In both cases, the gas evolved is H_2 . When calcium reacts with water the heat evolved is not sufficient for hydrogen to catch fire. On the other hand, sodium metal reacts with water violently and in this case a lot of heat is evolved which is sufficient for hydrogen to catch fire.

Q. 6. An ore on treatment with dilute hydrochloric acid produces brisk effervescence. Name the type of ore with one example. What steps will be required to obtain metal from the enriched ore? Also write the chemical equations for the reactions involved in the process.

[CBSE 2019 (31/5/1)]

Ans. ● Carbonate ore

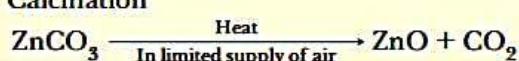
½

Zinc carbonate

½

● Calcination

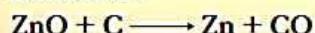
½



½

● Reduction:

½



½

[CBSE Marking Scheme 2019 (31/5/1)]

Q. 7. An ore on treatment with dil. HCl gives the smell of rotten egg. Name the type of this ore. How can the metal be obtained from its concentrated ore? [CBSE 2019 (31/5/2)]

Ans.

8.

Smell of rotten eggs is usually produced by Sulphur.

∴ It must be a sulphide ore.

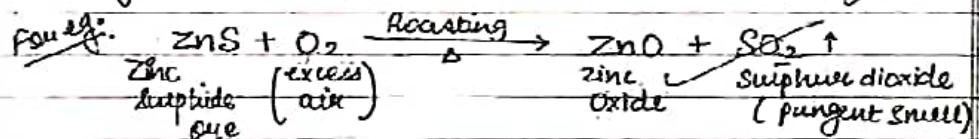
Let us suppose that the ore is Zinc Blende (ZnS).

Concentration of ore

First of all, the ore is concentrated by the method of Froth floatation.

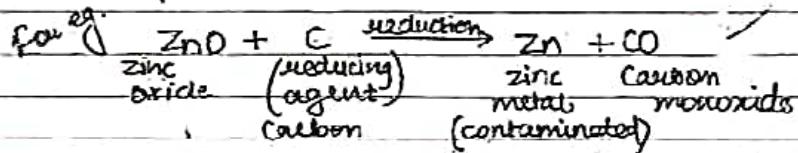
Conversion into metal oxide:

Then it is ~~coated~~ converted into its metal oxide via Roasting in supply of excess air.



Conversion into metal

It is then converted into its metal form by using a reducing agent like Carbon, Aluminium etc.

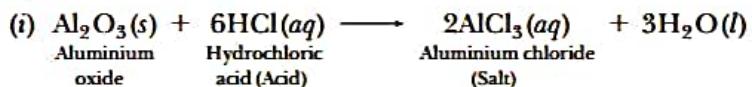


It is further refined to get it in its pure form.

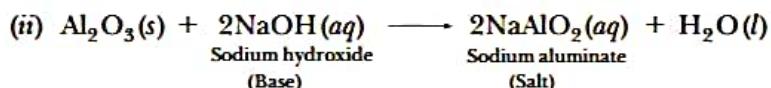
[Topper's Answer 2019]

Q. 8. Why is aluminium oxide considered an amphoteric oxide? [CBSE Sample Paper 2020]

Ans. Aluminium oxide (Al_2O_3) shows basic as well as acidic behaviour because it reacts with both acids and bases. Thus, it is considered as an amphoteric oxide. The two types of reactions given by Al_2O_3 are as follows:



In this reaction, Al_2O_3 behaves as a basic oxide because it reacts with an acid to form salt and water.



In this reaction, Al_2O_3 behaves as an acidic oxide because it reacts with a base to form salt and water.

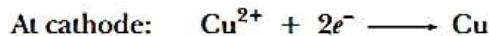
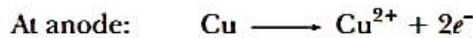
Q. 18. Give the differences between electrolytic reduction and reduction with carbon.

Ans.

Reduction with carbon	Electrolytic reduction
1. Carbon is used as a reducing agent.	1. Electrolysis process is used for reduction.
2. Oxides of moderately reactive metals (e.g., Zn, Fe, Cu, Ni) are reduced by carbon.	2. Oxides (and chlorides) of highly reactive metals (e.g., Al, Na, K, Mg, Ca) are reduced by this process.
3. In this process, the metal oxide is mixed with carbon (coke) and heated in a furnace.	3. In this process, molten metal oxide is electrolysed in an electrolytic cell where the cathode acts as a powerful reducing agent by supplying electrons to reduce metal ions into metal.

Q. 19. What is meant by refining of metals? Describe the electrolytic refining of copper with a neat labelled diagram.

Ans. In electrolytic refining process, the impure metal is made as anode and a thin strip of pure metal is made as cathode. A solution of the metal salt is made as an electrolyte. On passing the current through the electrolyte, the pure metal from the anode dissolves into the electrolyte. An equivalent amount of pure metal from the electrolyte is deposited on the cathode. The soluble impurities go into the solution, whereas, the insoluble impurities settle down at the bottom of the anode and are known as anode mud.



Q. 20. During extraction of metals, electrolytic refining is used to obtain pure metals.

- (i) Which material will be used as anode and cathode for refining of silver metal by this process?
 - (ii) Suggest a suitable electrolyte also.
 - (iii) In this electrolytic cell, where do we get pure silver after passing electric current?

[NCERT Exemplar]

Ans. (i) Anode: Impure silver

Cathode: Pure silver

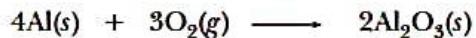
(ii) Electrolyte: Silver salt, such as AgNO_3 , AgCl , etc.

(iii) We get pure silver at cathode.

Q. 21. A metal A, which is used in thermite process, when heated with oxygen gives an oxide B, which is amphoteric in nature. Identify A and B. Write down the reactions of oxide B with HCl and NaOH. [NCERT Exemplar] [CBSE 2019 (31/4/3)] [HOTS]

[NCERT Exemplar] [CBSE 2019 (31/4/3)] [HOTS]

Ans. A is aluminium (Al). It reacts with oxygen to form aluminium oxide, Al_2O_3 .



So, B is Al_2O_3 .

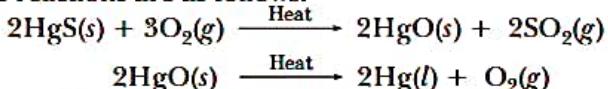


Q. 22. A metal that exists as a liquid at room temperature is obtained by heating its sulphide in the presence of air. Identify the metal and its ore and give the reaction involved.

[NCERT Exemplar] [CBSE 2019 (31/3/3)]

Ans. Metals low in activity series can be obtained by reducing their sulphides or oxides by heating. Mercury is the only metal that exists as liquid at room temperature. It can be obtained by heating cinnabar (HgS), the sulphide ore of mercury.

The reactions are as follows:

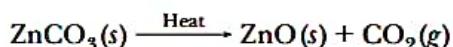


Q. 23. How is the method of extraction of metals high up in the reactivity series different from that for the metals in the middle? Why can the same process not be applied for them? Name the process used for the extraction of these metals. [CBSE 2019 (31/4/1)]

Ans. The metals in the middle of the reactivity series usually present as sulphides or carbonates in nature. The sulphide ores are converted into oxides by heating strongly in the presence of excess air known as **roasting**.



The carbonate ores are changed into oxides by heating strongly in the limited air known as **calcination**.

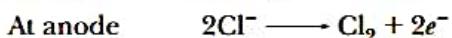


The metal oxide obtained is then reduced to metal by using suitable reducing agents such as carbon or highly reactive metals such as sodium, calcium, aluminium, etc.



The metals high up in the reactivity series are obtained by **electrolytic reduction**. They cannot be obtained by heating with carbon because these metals have more affinity for oxygen than carbon.

Electrolytic reduction: Sodium, calcium and magnesium are obtained by the electrolysis of their molten chlorides. The metals are deposited at the cathode and chlorine gas is liberated at the anode.



Q. 24. How can a layer of aluminium oxide on an aluminium object be made thicker? What is this process called?

Ans. Aluminium develops a thin oxide layer when exposed to air. This aluminium oxide coat makes it resistant to further corrosion. The resistance can be improved further by making the oxide layer thicker. This process is called **anodising**.

During anodising, 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 can be dyed easily to give aluminium articles an attractive finish.

Q. 25. 'M' is an element which is out of Cu, Fe, Al, Na. It shows the following properties:

(i) One of its ore is rich in M_2O_3 .

(ii) M_2O_3 is not affected by water.

(iii) It corrodes easily.

(iv) It forms two chlorides MCl_2 and MCl_3 . Identify 'M'. [Competency Based Question]

Ans. As the metal 'M' forms oxide M_2O_3 , it is trivalent. Out of the metals listed, only Fe and Al are trivalent. M_2O_3 is not affected by water, so 'M' can be out of Fe or Al.

Fe and Al both corrode easily.

Out of Al and Fe, only Fe can form divalent chloride, so the element 'M' is Fe.

Q. 26. Which two metals do not corrode easily? Give an example in each case to support that

- (i) corrosion of some metals is an advantage.
- (ii) corrosion of some metals is a serious problem.

Ans. Gold and platinum.

- (i) A thin impervious layer of aluminium oxide forms a protective layer which protects the aluminium metal underneath from further damage.
- (ii) Corrosion of iron is a serious problem. Every year enormous amount of money is spent to replace damaged iron and steel structures.

Q. 27. In the formation of the compound XY, atoms of X lost one electron each while atoms of Y gained one electron each. What is the nature of bond in XY? Predict the two properties of XY.

Ans. The atoms of X lose electrons whereas the atoms of Y gain electrons. Thus, there is transfer of electrons from atoms of X to atoms of Y. The bond formed by the transfer of electrons is called ionic bond. Therefore, the nature of bond in the compound XY is ionic.

Properties of ionic compound XY:

- (i) The compound will be soluble in water.
- (ii) The compound will conduct electricity when dissolved in water or in molten state.

Q. 28. List three differentiating features between the processes of galvanisation and alloying.

[CBSE 2020 (31/4/1)]

Ans.

Galvanisation	Alloying
<ul style="list-style-type: none">1. Coating a layer of zinc metal on the metal.2. Not a homogeneous mixture.3. No change in physical properties of metals takes place.4. The process is an outcome of the reactivity of metals.5. Prevents rusting only.	<ul style="list-style-type: none">1. Mixing of a metal with metal or non-metal.2. Homogeneous mixture.3. Change in physical properties of metals takes place.4. Reactivity of metals do not play any role in it.5. Some alloys may prevent rusting and also used for other advantages.

1 × 3
(Any Three)

[CBSE Marking Scheme 2020 (31/4/1)]

Long Answer Questions

Each of the following questions are of 5 marks and have to be answered in about 80-120 words.

Q. 1. A non-metal A, is an important constituent of our food and forms two oxides B and C. Oxide B is toxic whereas C causes global warming.

- (i) Identify A, B and C
- (ii) To which group of Periodic Table does A belong? [NCERT Exemplar] [HOTS]

Ans. (i) 'A' is carbon. Its two oxides are carbon monoxide, CO and carbon dioxide, CO₂. CO is toxic so 'B' is carbon monoxide and carbon dioxide causes global warming, so 'C' is carbon dioxide i.e., CO₂.

- (ii) 'A' belongs to group 14 of the Periodic Table.

Q. 2. (a) What is thermit process? Where is this process used? Write balanced chemical equation for the reaction involved.
(b) Where does the metal aluminium, used in the process, occurs in the reactivity series of metals?
(c) Name the substances that are getting oxidised and reduced in the process.

[CBSE 2020 (31/1/2)]

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[CBSE 2020 (31/1/2)]

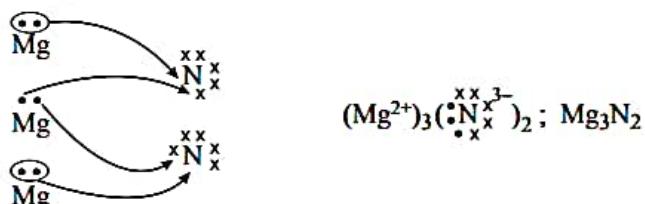
Ans.	(a) ● The highly exothermic displacement reaction between iron oxide and aluminium powder.	1
	● It is used to join railway tracks or cracked machine parts.	1
	● $\text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \longrightarrow \text{Fe}(l) + \text{Al}_2\text{O}_3(s) + \text{Heat}$	1
	(b) It is placed above iron / towards top in the reactivity series.	1
	(c) Oxidised $\rightarrow \text{Al}$. Reduced $\rightarrow \text{Fe}_2\text{O}_3$	$\frac{1}{2}$ $\frac{1}{2}$

[CBSE Marking Scheme 2020 (31/1/2)]

- Q. 3.** (i) Explain the formation of Mg_3N_2 by the transfer of electrons.
(ii) Name the ions present in the compound.
(iii) Write about the solubility of these compounds.

Ans. (i) The atomic number of magnesium is 12. Its electronic configuration is 2, 8, 2. So, it has a tendency to donate 2 valence electrons and forms Mg^{2+} ion. The atomic number of nitrogen is 7. Its electronic configuration is 2, 5. So it has a tendency to gain 3 electrons to complete its octet and form N^{3-} ion.

When magnesium and nitrogen are brought together, three magnesium atoms donate 2 electrons each to two nitrogen atoms and in this way they acquire the nearest stable noble gas configuration.



- (ii) The ions present are Mg^{2+} and N^{3-} .
(iii) Mg_3N_2 is an ionic compound. It is soluble in water but insoluble in solvents such as kerosene, petrol, etc.

Q. 4. What are ionic or electrovalent compounds? Give an example of ionic compound. Explain with reason four properties of these compounds. [CBSE 2019 (31/3/1)]

Ans. Ionic compounds are those compounds which are formed by the transfer of electrons from a metal to a non-metal. For example, NaCl .

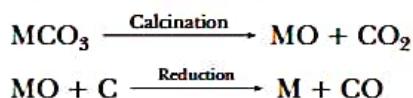
Properties:

- (i) **Physical nature:** Ionic compounds are hard and solid due to strong force of attraction between oppositely charged ions.
- (ii) **Melting point and boiling point:** As more amount of energy is required to break strong bonds. So, they have high melting point and boiling point.
- (iii) **Solubility:** These are soluble in water (polar solvent) but insoluble in organic solvent.
- (iv) **Conduction of electricity:** They conduct electricity in solution or molten state as ions move towards opposite electrodes.

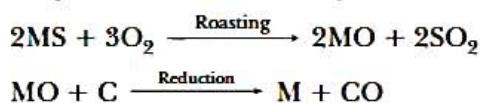
Q. 5. Two ores A and B were taken. On heating ore A gives CO_2 whereas, ore B gives SO_2 . What steps will you take to convert them into metals? [NCERT Exemplar]

Ans. Since ore A gives CO_2 and ore B gives SO_2 . Therefore, ores are MCO_3 and MS .

As A is a carbonate ore, it is first subjected to calcination followed by reduction.



As B is a sulphide ore, it is first subjected to roasting followed by reduction.



- Q. 6. Metal X is found in nature as its sulphide XS. It is used in the galvanisation of iron articles. Identify the metal X. How will you convert this sulphide ore into the metal? Explain with equations. [CBSE Sample Paper 2020]

Ans. Metal X is Zinc.

The sulphide ore is first heated strongly in supply of oxygen and changed into its oxide. This process is called roasting.



Zinc oxide is then reduced to zinc metal by heating it with carbon. This process is called reduction.



- Q. 7. (a) Complete and balance the following chemical equations :



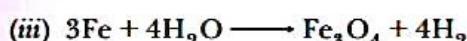
- (b) An element 'X' displaces iron from the aqueous solution of iron sulphate. List your observations if the element 'X' is treated with the aqueous solutions of copper sulphate, zinc sulphate and silver nitrate. Based on the observations arrange X, Zn, Cu and Ag in increasing order of their reactivities. [CBSE 2020 (31/2/2)]

Ans. (a) (i) $\text{Al}_2\text{O}_3 + 6\text{HCl} \longrightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$

1



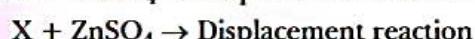
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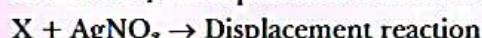
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½



½



½



½

[CBSE Marking Scheme 2020 (31/2/2)]

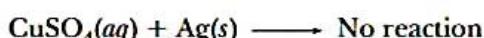
- Q. 8. (i) Hydrogen is not a metal but it has been assigned a place in the reactivity series of metals. Explain.

- (ii) How would you show that silver is chemically less reactive than copper?

Ans. (i) Though hydrogen is not a metal but even then it has been assigned a place in the activity series. The reason is that like metals, hydrogen also has a tendency to lose electron and forms a positive ion H^+ .

The metals which lose electrons less readily than hydrogen are placed below it and the metals which lose electrons more readily than hydrogen are placed above it in the reactivity series of metals.

- (ii) By displacement reaction, silver can be shown to be chemically less reactive than copper or copper is more reactive than silver. If a piece of silver is immersed in a solution of copper sulphate, no reaction will take place because silver is less reactive than copper and will not displace copper from the copper sulphate solution.



On the other hand, if a copper plate is placed in a solution of silver nitrate, copper will slowly displace silver from the solution and blue solution of copper nitrate is formed.



This shows that copper is more reactive than silver.

- Q. 9.** (i) By the transfer of electrons, illustrate the formation of bond in magnesium chloride and identify the ions present in this compound.
(ii) Ionic compounds are solids. Give reasons.
(iii) With the help of a labelled diagram show the experimental set up of action of steam on a metal. [CBSE 2020 (31/3/1)]

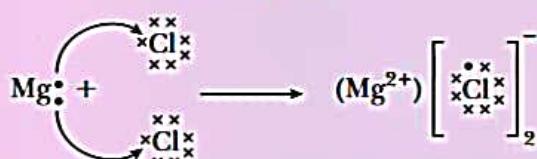
[CBSE 2020 (31/3/1)]

Ans. (i) $\text{Mg} \xrightarrow[2,8,2]{} \text{Mg}^{2+} + 2e^-$
(Magnesium cation)

17

$$\begin{array}{ccc} \text{Cl} + e^- \longrightarrow & \text{Cl}^- \\ 2,8,7 & & 2,8,8 \\ & & (\text{Chloride anion}) \end{array}$$

12



1

(ii) In ionic compounds, very strong forces of attraction exist between positive and negative ions.

(iii)

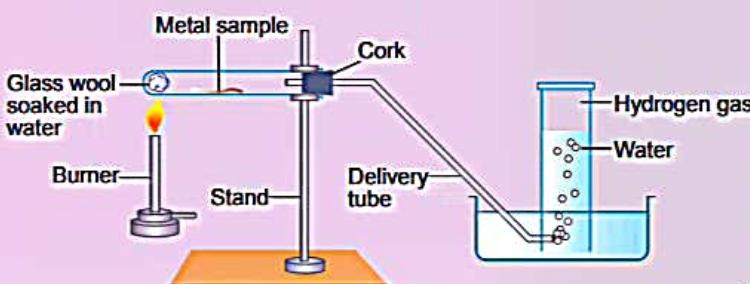


Diagram 1

(Any two labelling) $\frac{1}{2}, \frac{1}{2}$

[CBSE Marking Scheme 2020 (31/3/1)]

- Q. 10.** Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals. Why? Where are these metals placed in the reactivity series?

How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations. [CBSE 2020 (31/1/1)]

Ans.

- These metals have more affinity for oxygen than carbon.
- Towards the top of the reactivity series .
- By electrolytic reduction of their molten ores.
- Example: Extraction of sodium from molten sodium chloride.

Process:

- Molten NaCl is taken in an electrolytic cell and on passing electricity Na is deposited at cathode and chlorine is liberated at anode.

Reactions

- At cathode - $\text{Na}^+ + e^- \longrightarrow \text{Na}$

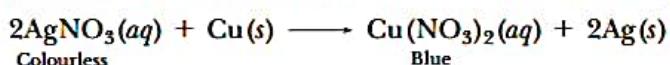
At anode -

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(or any other example) $\frac{1}{2}$

[CBSE Marking Scheme 2020 (31/1/1)]

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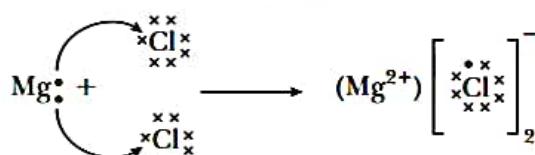
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(Magnesium cation)

1/2

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14



1

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(iii)

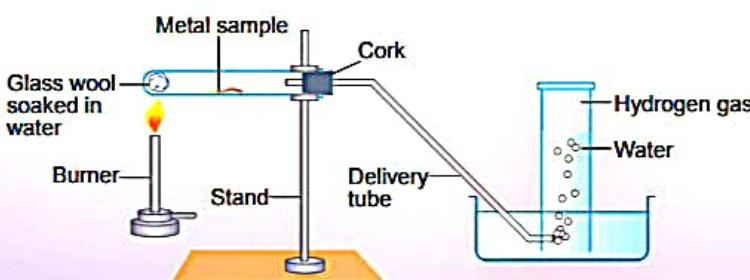


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(Any two labelling) $\frac{1}{2}, \frac{1}{2}$

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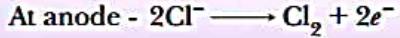
- Molten NaCl is taken in an electrolytic cell and on passing electricity Na is deposited at cathode and chlorine is liberated at anode.

Reactions:

- At cathode - $\text{Na}^+ + e^- \longrightarrow \text{Na}$

At anode -

1½



(or any other example) $\frac{1}{2}$

[CBSE Marking Scheme 2020 (31/1/1)]

Q. 11. A metal 'M' is stored under kerosene. It vigorously catches fire, if a small piece of this metal is kept open in air. Dissolution of this metal in water releases great amount of energy and the metal catches fire. The solution so formed turns red litmus blue.

- Name the metal 'M'.
- Write formula of the compound formed when this metal is exposed to air.
- Why is metal 'M' stored under kerosene?
- If oxide of this metal is treated with hydrochloric acid, what would be the products?
- Write balanced equations for:
 - Reaction of 'M' with air.
 - Reaction of 'M' with water.
 - Reaction of metal oxide with hydrochloric acid

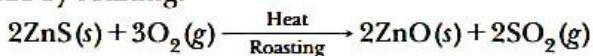
[CBSE 2020 (31/3/3)]

Ans.	(a) Sodium (b) Na_2O (c) It catches fire, if kept in open (d) NaCl and H_2O (e) (i) $4\text{M} + \text{O}_2 \longrightarrow 2\text{M}_2\text{O}$ (ii) $2\text{M} + 2\text{H}_2\text{O} \longrightarrow 2\text{MOH} + \text{H}_2 + \text{Heat energy.}$ (iii) $\text{M}_2\text{O} + 2\text{HCl} \longrightarrow 2\text{MCl} + \text{H}_2\text{O}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1 1 1
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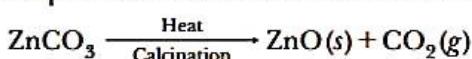
[CBSE Marking Scheme 2020 (31/3/3)]

- Q. 12.** (i) Distinguish between 'roasting' and 'calcination'. Which of these two is used for sulphide ores and why?
 (ii) Write a chemical equation to illustrate the use of aluminium for joining cracked railway lines.
 (iii) Name the anode, the cathode and the electrolyte used in the electrolytic refining of impure copper.

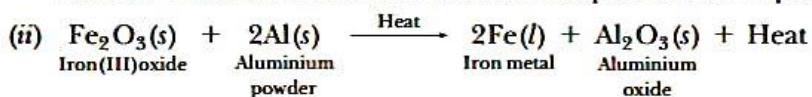
Ans. (i) **Roasting:** It is the process in which sulphide ores of the metals are converted into oxides by heating them in the presence of excess air. For example, zinc sulphide is converted into zinc oxide by roasting.



Calcination: It is the process in which carbonate ores of the metals are decomposed into oxides by heating them in the absence or limited air. For example, zinc carbonate is decomposed into zinc oxide and carbon dioxide by calcination.



Out of roasting and calcination, only roasting is used for sulphide ores. This is because it is easier to obtain metal from its oxide as compared to its sulphide.



(iii) Anode — Impure copper

Cathode — Strip of pure copper

Electrolyte — Acidified copper sulphate solution.

- Q. 13.** (a) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.
 (b) How is copper extracted from its sulphide ore? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

[CBSE 2018]

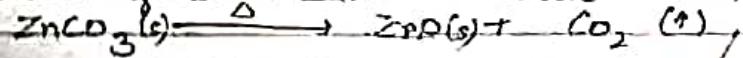
Ans.

Answer: 16

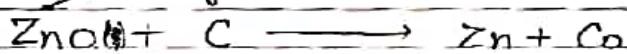
- (i) Extraction of pure metals from 'CO₃' ores :-
(ii) Concentration of ore
Gangue or impurities must be removed from ore by processes taking in mind differences in physical & chemical properties of gangue & ore.

(iii) Calcination :-

The carbonate ores must be heated strongly in absence of air to convert them into metal ores.



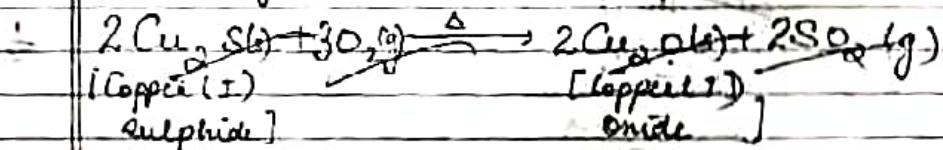
- (iv) Reduction by a more reactive metal or carbon



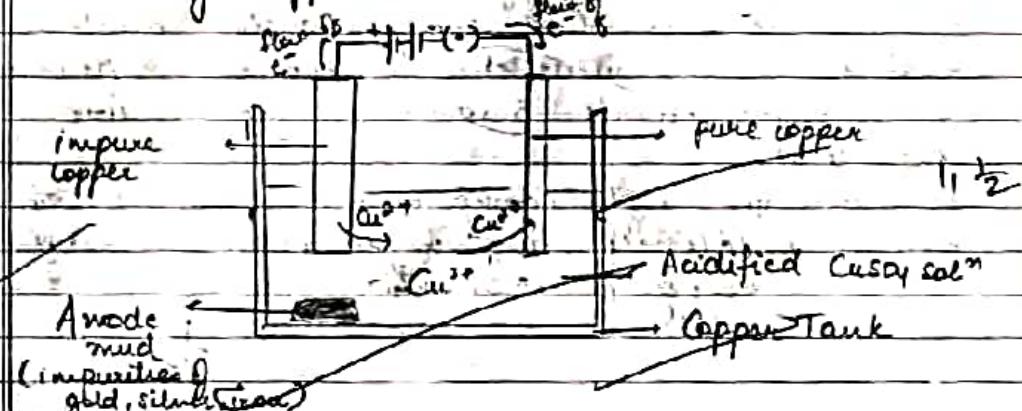
This will happen as Carbon has higher affinity for gaseous oxygen than zinc.

- (v) Finally, the obtained metal can be refined by electrolysis of their salt solution.

- (vi) Copper glance [Cu₂S] is copper's sulphide ore. It is first roasted & then reduced by the remaining Cu₂S in tank.



This way, copper metal is extracted



Electrolytic refining

[Topper's Answer 2018]

Q. 14. A non-metal A which is the largest constituent of air, when heated with H_2 in 1 : 3 ratio in the presence of catalyst (Fe) gives a gas B. On heating with O_2 it gives an oxide C. If this oxide is passed into water in the presence of air it gives an acid D which acts as a strong oxidising agent.

(i) Identify A, B, C and D.

(ii) To which group of periodic table does this non-metal belong?

[NCERT Exemplar] [HOTS]

Ans. (i) 'A' is N_2 , nitrogen gas.

When N_2 is heated with H_2 in 1 : 3 ratio in the presence of catalyst (Fe), ammonia gas is produced.

So, 'B' is NH_3 .



When N_2 reacts with O_2 , it forms an oxide, NO.



So, 'C' is NO.

When this oxide of nitrogen is passed into water in the presence of air, it forms HNO_3 i.e., nitric acid which is a strong oxidising agent.

So, 'D' is HNO_3 .

(ii) It belongs to group 15 of the periodic table.

Q. 15. Give reasons:

(i) Reactivity of Al decreases if it is dipped in HNO_3 .

[CBSE 2019 (31/1/3)]

(ii) Carbon cannot reduce the oxides of Na or Mg.

(iii) $NaCl$ is not a conductor of electricity in solid state whereas it does conduct electricity in aqueous solution as well as in molten state.

[CBSE 2019 (31/1/3)]

(iv) Iron articles are galvanised.

(v) Metals like Na, K, Ca and Mg are never found in their free state in nature.

[NCERT Exemplar] [CBSE 2019 (31/1/3)]

Ans. (i) Due to the formation of a coating of aluminium oxide/ Al_2O_3 .

(ii) Na or Mg are more reactive metals as compared to carbon. So, their oxides are more stable.

(iii) In molten state, due to heat the electrostatic forces of attraction between the oppositely charged ions are overcome. So ions move freely and conduct electricity.

In aqueous solutions ions are free and conduct electricity.

(iv) Iron articles are galvanised to protect them from corrosion.

(v) Reactive metals like Na, K, Ca and Mg react easily with different elements and occur in the form of ores.

Q. 16. (i) Write chemical equations for the following reactions:

(a) Calcium metal reacts with water.

(b) Cinnabar is heated in the presence of air.

(c) Manganese dioxide is heated with aluminium powder.

(ii) What are alloys? List two properties of alloys.

[CBSE 2019 (31/1/2)]

- Ans.** (i) (a) $\text{Ca} + 2\text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$ 1
 (b) $2\text{HgS} + 3\text{O}_2 \xrightarrow{\text{Heat}} 2\text{HgO} + 2\text{SO}_2$ 1
 (c) $3\text{MnO}_2 + 4\text{Al} \longrightarrow 2\text{Al}_2\text{O}_3 + 3\text{Mn}$ 1
 (ii) Alloys are homogeneous mixture of two or more metals or a metal and a non metal. 1
 Properties :
 Alloys are stronger / harder / have low melting point / more resistant to corrosion / some are magnetic in nature.
 (Any two) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme 2019 (31/1/2)]

Q. 17. Write balanced chemical equations to explain what happens, when:

- (i) Mercuric oxide is heated.
- (ii) Mixture of cuprous oxide and cuprous sulphide is heated.
- (iii) Aluminium is reacted with manganese dioxide.
- (iv) Ferric oxide is reduced with aluminium.
- (v) Zinc carbonate undergoes calcination.

[CBSE 2020 (31/3/1)]

- Ans.** (i) $2\text{HgO} \xrightarrow{\text{Heat}} 2\text{Hg} + \text{O}_2$ 1
 (ii) $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \xrightarrow{\text{Heat}} 6\text{Cu} + \text{SO}_2$ 1
 (iii) $3\text{MnO}_2 + 4\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 3\text{Mn} + \text{heat}$ 1
 (iv) $\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe} + \text{heat}$ 1
 (v) $\text{ZnCO}_3 \xrightarrow{\text{Heat}} \text{ZnO} + \text{CO}_2$ 1

[CBSE Marking Scheme 2020 (31/3/1)]

Self-Assessment

Time allowed: 1 hour

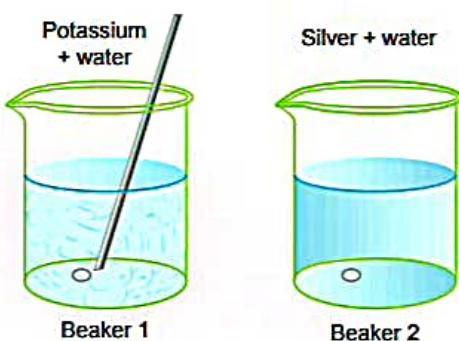
Max. marks: 40

SECTION-A

Choose and write the correct answer for each of the following.

$(4 \times 1 = 4)$

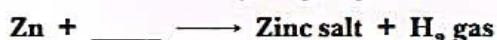
1. A student drops pieces of potassium and silver in beakers containing water. The image shows the reaction. [CBSE Question Bank]



What are the products formed in each beaker?

- (a) Beaker 1: K_2O and H_2O ; Beaker 2: No reaction takes place
- (b) Beaker 1: KOH and H_2O ; Beaker 2: Ag_2O and H_2O
- (c) Beaker 1: K_2O and H_2O ; Beaker 2: AgO and H_2O
- (d) Beaker 1: KOH and H_2O ; Beaker 2: No reaction takes place

2. A piece of zinc (Zn)—a reactive metal—was dropped into a test tube containing a substance. A zinc salt was formed and hydrogen gas was liberated. This is shown in the equation below.



Which of the following can be the substance that zinc was dropped into?

- P. water
 - Q. hydrochloric acid
 - R. a solution of a zinc salt

[CBSE Question Bank]

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

4. Which of the following can undergo a chemical reaction? [NCERT Exemplar]

- (a) $\text{MgSO}_4 + \text{Fe}$ (b) $\text{ZnSO}_4 + \text{Fe}$
 (c) $\text{MgSO}_4 + \text{Pb}$ (d) $\text{CuSO}_4 + \text{Fe}$

The following questions consist of two statements—Assertion(A) and Reason(R). Answer these questions selecting the appropriate option given below:

- (a) Both A and R are true and R is the correct explanation for A .
(b) Both A and R are true but R is not the correct explanation for A .
(c) A is true but R is false.
(d) A is false but R is true. $(2 \times 1 = 2)$

5. Assertion (A) : Zinc becomes dull in moist air.
Reason (R) : Zinc is coated by a thin film of its basic carbonate in moist air.

6. Assertion (A) : Anodising is a method to prevent metal from corrosion.
Reason (R) : Anodising is a process of coating iron with a layer of zinc.

Answer the following questions in one word or one sentence.

$$(3 \times 1 = 3)$$

7. Name the constituents of bronze.
 8. Name two metals which reacts with nitric acid and produces hydrogen gas.
 9. Define malleability.

SECTION-B

Answer the following questions in about 30-50 words each.

$$(2 \times 2 = 4)$$

10. A copper coin is kept immersed in a solution of silver nitrate for some time. What will happen to the coin and the colour of solution?

11. Give reason:

 - (i) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.
 - (ii) Aluminium is a highly reactive metal; still it is widely used in making cooking utensils.

[CBSE 2019 (31/2/2)]

SECTION-C

Answer the following questions in about 50-80 words each.

$$(4 \times 3 = 12)$$

12. An alkali metal A gives a compound B (molecular mass = 40) on reacting with water. The B gives a soluble compound C on treatment with aluminium oxide. Identify A, B and C and give the reaction involved. [NCERT Exemplar]

13. (i) Write two properties of gold which make it the most suitable metal for ornaments.
(ii) Name two metals which are the best conductors of heat.
(iii) Name two metals which melt when you keep them on your palm. [CBSE 2020 (31/4/1)]
14. A metal X is so soft that it can be easily cut with a knife. Its oxide, soluble in water, forms compound which turns red litmus solution blue. Identify X. Give your answer with chemical equation.
15. Given below are the steps for the extraction of copper from its ore. Write the chemical equation of the reactions involved in each case.
(i) Roasting of copper(I)sulphide
(ii) Reduction of copper(I)oxide from copper(I)sulphide
(iii) Electrolytic refining [CBSE 2019 (31/2/3)]

SECTION-D

Answer the following questions in about 80–120 words each.

(3 × 5 = 15)

16. The electronic configuration of four elements are given:
A: 2, 8, 1 B: 2, 8, 2
C: 2, 8, 7 D: 2, 6
Answer the following questions:
(i) Which one among A, B, C and D forms monovalent cation?
(ii) Which one among A, B, C and D forms divalent cation?
(iii) Which one among A, B, C and D forms monovalent anion?
(iv) Explain the bonding between (i) A and C (ii) B and C (iii) A and D (iv) B and D.
17. (i) Write electron dot structures of Ca ($Z = 20$) and O ($Z = 8$).
(ii) Show the formation of calcium oxide by transfer of electrons.
(iii) Name the ions present in this compound.
(iv) List four important characteristics of this compound. [CBSE 2020 (31/3/3)]
18. What happens when (Write the balanced equation involved):
(i) Copper is heated in air?
(ii) Aluminium oxide is reacted with hydrochloric acid?
(iii) Potassium reacts with water?
(iv) Cinnabar is heated in air?
(v) Aluminium oxide reacts with sodium hydroxide? [CBSE 2020 (31/2/1)]

Answers

1. (d) 2. (b) 3. (c) 4. (d) 5. (a) 6. (c)

7. Copper and Tin

8. Magnesium and Manganese

9. The property of metal by virtue of which it can draw into thin sheets is known as malleability.

