

CHAPTER

3

METALS AND
NON-METALS

Syllabus

Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.



STAND ALONE MCQs

(1 mark each)

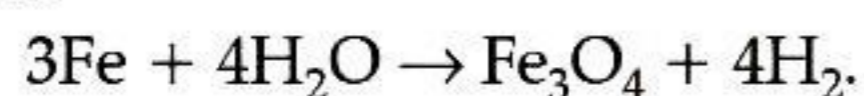
Q. 1. Which one of the following metals does not react with cold as well as hot water?

- (A) Na (B) Ca
(C) Mg (D) Fe

A

Ans. Option (D) is correct.

Explanation: Metals like aluminium, zinc, iron do not react with hot/cold water. They react with water only when water is in the form of steam.



Q. 2. What happens when calcium is treated with water?

- (i) It does not react with water.
(ii) It reacts violently with water.
(iii) It reacts less violently with water.
(iv) Bubbles of hydrogen gas formed stick to the surface of calcium.

- (A) (i) and (iv) (B) (ii) and (iii)
(C) (i) and (ii) (D) (iii) and (iv)

U

Ans. Option (D) is correct.

Explanation: Calcium reacts slowly with water. The reaction forms calcium hydroxide, $\text{Ca}(\text{OH})_2$ and hydrogen gas (H_2). The calcium metal sinks in water and after an hour or so bubbles of hydrogen are observed, stuck to the surface of the metal.

Q. 3. Generally, non-metals are not lustrous. Which of the following non-metal is lustrous?

- (A) Sulphur (B) Oxygen
(C) Nitrogen (D) Iodine

A

Ans. Option (D) is correct.

Explanation: Iodine is a non-metal but it is lustrous.

Q. 4. An element A is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following:

- (A) Mg (B) Na
(C) P (D) Ca

U

Ans. Option (B) is correct.

Explanation: Sodium is so soft that can be cut using a knife. It reacts with oxygen or moisture present in air readily and reacts with water vigorously. Because of this sodium is stored in kerosene oil to prevent any reaction or accident.

Q. 5. Which among the following statements is incorrect for magnesium metal?

- (A) It burns in oxygen with a dazzling white flame
(B) It reacts with cold water to form magnesium oxide and evolves hydrogen gas
(C) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas
(D) It reacts with steam to form magnesium hydroxide and evolves hydrogen gas

U

Ans. Option (B) is correct.

Explanation: Magnesium when reacts with water gives magnesium hydroxide and hydrogen gas and not magnesium oxide.

Q. 6. Electrical wires have a coating of an insulating material. The material, generally used is

- (A) Sulphur (B) Graphite
(C) PVC (D) All can be used U

Ans. Option (C) is correct.

Explanation: PVC is a polymer and bad conductor of electricity. It is used as an insulating material for covering electric wires. Graphite is good conductor of electricity, so cannot be used as insulating material. Sulphur is a non-metal although non-conductor of electricity but brittle in nature. So, cannot be used as insulating material.

Q. 7. Food cans are coated with tin and not with zinc because

- (A) zinc is costlier than tin
(B) zinc has a higher melting point than tin
(C) zinc is more reactive than tin
(D) zinc is less reactive than tin A

Ans. Option (C) is correct.

Explanation: Food cans are coated with tin and not with zinc because zinc is more reactive than tin.

AI Q. 8. Which of the given metals is stored under kerosene to prevent oxidation?

- (A) Copper (B) Potassium
(C) Magnesium (D) Calcium R

Ans. Option (B) is correct.

Explanation: Potassium and Sodium react vigorously with oxygen in air and catch fire. These metals are stored under kerosene oil to prevent oxidation.

Q. 9. Which of the following metals exist in their native state in nature?

- (i) Cu (ii) Au
(iii) Zn (iv) Ag
(A) (i) and (ii) (B) (ii) and (iii)
(C) (ii) and (iv) (D) (iii) and (iv)

Ans. Option (C) is correct.

Explanation: Metals such as gold and silver are found as native metals.

Q. 10. Galvanization is a method of protecting iron from rusting by coating with a thin layer of

- (A) Gallium (B) Aluminium
(C) Zinc (D) Silver

Ans. Option (C) is correct.

Explanation: In the process of galvanization, iron is covered by a coat of zinc. This layer of zinc prevents iron from getting rusted.

Q. 11. Which of the following metals are obtained by electrolysis of their chlorides in molten state?

- (i) Na (ii) Ca
(iii) Fe (iv) Cu
(A) (i) and (iv) (B) (iii) and (iv)
(C) (i) and (iii) (D) (i) and (ii)

Ans. Option (D) is correct.

Explanation: Sodium and calcium fall towards the top of reactivity series. Since, sodium and calcium are very reactive, these metals cannot be reduced to pure form, from their oxides or carbonates.

Thus, sodium and calcium are obtained by the process of electrolysis of their chlorides.

Q. 12. An electrolytic cell consists of

- (i) positively charged cathode
(ii) negatively charged anode
(iii) positively charged anode
(iv) negatively charged cathode
(A) (i) and (ii) (B) (iii) and (iv)
(C) (i) and (iii) (D) (ii) and (iv) R

Ans. Option (B) is correct.

Explanation: Positively charged ions are called cations as they are deposited at negatively charged pole. Negatively charged ions are called anions as these are deposited at positively charged pole. That's why the negatively charged pole is called cathode and positively charged pole is called anode.

AI Q. 13. Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents?

- (A) Brass (B) Bronze
(C) Amalgam (D) Steel

Ans. Option (D) is correct.

Explanation: Steel is an alloy of iron and carbon. Mixing of carbon gives strength to iron.

Q. 14. Which of the following are not ionic compounds?

- (i) KCl (ii) HCl
(iii) CCl₄ (iv) NaCl
(A) (i) and (ii) (B) (ii) and (iii)
(C) (iii) and (iv) (D) (i) and (iii) U

Ans. Option (B) is correct.

Explanation: HCl and CCl₄ are not ionic compounds because they are formed by sharing of electrons. These are covalent compounds.

Q. 15. Metals are refined by using different methods. Which of the following metals are refined by electrolytic refining?

- (i) Au (ii) Cu
(iii) Na (iv) K
(A) (i) and (ii) (B) (i) and (iii)
(C) (ii) and (iii) (D) (iii) and (iv) U

Ans. Option (A) is correct.

Explanation: Sodium and potassium are extracted by electrolytic reduction. Metals obtained after electrolytic reduction are in pure form. But, copper and gold are in impure form after extraction. Copper and gold are refined by electrolytic refining methods.

- Q. 16. During electrolytic refining of zinc, it gets
- (A) deposited on cathode
 - (B) deposited on anode
 - (C) deposited on cathode as well as anode
 - (D) remains in the solution

Ans. Option (A) is correct.

Explanation: Ions of zinc are positively charged, thus while electrolytic refining of zinc, zinc is deposited at cathode (negatively charged pole).



ASSERTION AND REASON BASED MCQs (1 Mark each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

- (A) Both A and R are true and R is the correct explanation of A.
- (B) Both A and R are true but R is NOT the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false and R is true.

Q. 1. **Assertion (A):** When a piece of copper metal is added to dilute sulphuric acid, the solution turns blue.

Reason (R): Copper reacts with dilute sulphuric acid to form blue copper (II) sulphate solution.

Ans. Option (D) is correct.

Explanation: When a piece of copper metal is added to dilute sulphuric acid, then it shows no reaction at normal temperature. It is because, copper reacts only with heated sulphuric acid to form blue copper (II) sulphate solution.

Q. 2. **Assertion (A):** Metals are sonorous.

Reason (R): They are generally brittle in the solid state; they break into pieces when hammered.

Ans. Option (C) is correct.

Explanation: Metals are sonorous, malleable and ductile while non-metals are brittle.

Q. 3. **Assertion (A):** Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid.

Reason (R): Carbon dioxide is given off in the reaction.

Ans. Option (A) is correct.

Explanation: Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid as CO_2 gas is released.

Q. 4. **Assertion (A):** Aluminium is more reactive than iron. Its corrosion is less than that of iron.

Reason (R): Aluminium is covered with a strong protective layer of oxide which protects the metal from further corrosion.

Ans. Option (A) is correct.

Explanation: Aluminium is covered with a strong protective layer of oxide, which protects the metal from further corrosion. So, although aluminium is more reactive than iron, its corrosion is less than that of iron.

Q. 5. **Assertion (A):** A mineral is called ore, when metal is extracted from it conveniently and economically.

Reason (R): All ores are minerals but all minerals are not ores.

Ans. Option (B) is correct.

Explanation: Minerals are naturally occurring chemical substances in the earth's crust obtained by mining. But a mineral is called an ore only when the metal can be extracted from it conveniently and economically. Thus, all ores are minerals but all minerals are not ores.

Q. 6. **Assertion (A):** In the metallurgy of Al, purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2 .

Reason (R): It lowers the melting point of the mixture and brings conductivity.

Ans. Option (A) is correct.

Explanation: In the metallurgy of aluminium, purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2 which lowers the melting point of the mixture and brings conductivity.

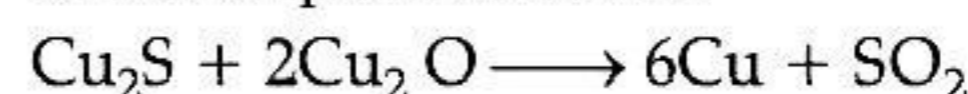
Q. 7. **Assertion (A):** Usually the sulphide ore is converted to oxide before reduction.

Reason (R): Reduction of oxides occurs easier.

Ans. Option (A) is correct.

Explanation: Usually the sulphide ore is converted to oxide before reduction as oxides are easier to reduce.

Q. 8. **Assertion (A):** While the extraction of copper, one of the steps involved is



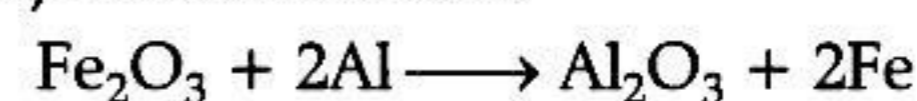
Reason (R): In this reaction Cu_2S is the reducing agent whereas Cu_2O is the oxidising agent.

Ans. Option (C) is correct.

Explanation: The Cu^{2+} ion in both the compounds gets reduced while sulphur gets oxidised.

Q. 9. **Assertion (A):** In aluminothermite process, the metals like iron melts due to the heat evolved in the reaction.

Reason (R): The reaction is:



Ans. Option (A) is correct.

Explanation: Large amount of heat is evolved which melts iron and can be used for welding.



CASE-BASED MCQs

AI Attempt any 4 sub-parts from each question. Each sub-part carries 1 mark.

I. Read the following and answer any four questions from Q.1. to Q.5.

A student took the samples of four metals A, B, C and D and added following solutions 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

Q. 1. Choose the most reactive metal:

- (A) A (B) B
(C) C (D) D

Ans. Option (B) is correct.

Explanation: B is the most reactive metal as it displaces iron from its salt solution.

Q. 2. Which of the following will displace Cu from its solution of sulphate:

- (A) A only (B) B only
(C) Both A and B (D) None of the above

Ans. Option (B) is correct.

Explanation: B will displace Cu from CuSO_4 solution because B is more reactive than copper.

Q. 3. Which is the correct decreasing order of reactivity?

- (A) $B > A > C > D$ (B) $A > B > D > C$
(C) $D > B > A > C$ (D) $B > A > D > C$

Ans. Option (A) is correct.

Explanation: The order of decreasing reactivity is : $B > A > C > D$

B will displace Cu from CuSO_4 solution because B is more reactive than copper.

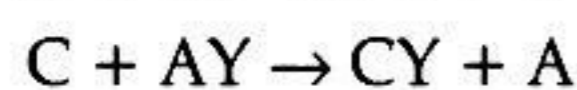
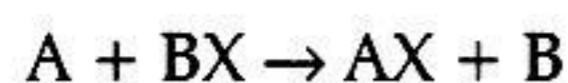
Q. 4. The gas produced when dil. HCl is added to a reactive metal:

- (A) Oxygen (B) Nitrogen
(C) Hydrogen (D) None of the above

Ans. Option (C) is correct.

Explanation: Hydrogen gas is produced when dilute HCl is added to a reactive metal.

Q. 5. On the basis of sequence of reactions, identify the most and least reactive elements.



- (A) Most reactive: C; Least reactive: B
(B) Most reactive: B; Least reactive: C
(C) Most reactive: A; Least reactive: B
(D) Most reactive: B; Least reactive: A

Ans. Option (A) is correct.

Explanation: The most reactive metal is C and the least reactive metal is B.

II. Read the following and answer any four questions from Q.1. to Q.5.

When a silvery grey powder of a solid (A) is mixed with a powder of solid (B) no reaction occurs. But if the mixture is ignited and lighted using magnesium ribbon a reaction occurs with evolution of large amount of heat forming product (C) which settles down as liquid metal and the solid product (D) formed floats on the liquid (C). (C) in solid form reacts with moisture to form rust. The amount of heat generated during the reaction is so high that the reaction is used in welding of electric conductors, joints in railway tracks. Based on this information, answer any four questions from Q. 1. to Q. 5.

Q. 1. Identify A and C?

- (A) A – Al and C – Fe (B) A – Fe and C – Al
(C) A – Mg and C – Al (D) A – Al and C – Cu

Ans. Option (A) is correct.

Explanation: A is Al, and C is Fe, O_3
 $2\text{Al (A)} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe (C)} + 2\text{Al}_2\text{O}_3$

Q. 2. Identify B and D which are oxides of:

- (A) B – Fe, D – Al (B) B – Mg, D – Al
(C) B – Al, D – Cu (D) B – Al, D – Fe

Ans. Option (A) is correct.

Explanation: B is Fe_2O_3 , and D is Al_2O_3
 $2\text{Al} + \text{Fe}_2\text{O}_3 \text{ (B)} \rightarrow 2\text{Fe} + 2\text{Al}_2\text{O}_3 \text{ (D)}$

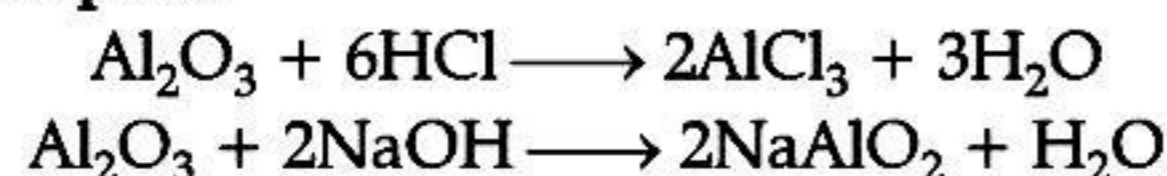
Q. 3. Amphoteric oxides are:

- (A) Metal oxides which do not react with acids but reacts with bases.
(B) Metal oxides which reacts with both acids as well as bases.
(C) Metal oxides which reacts with acids but do not react with bases.
(D) Metal oxides which shows no reaction with either acids or bases.

Ans. Option (B) is correct.

Explanation: Metal oxides which react with both acids as well as bases to produce salt and water are called amphoteric oxides.

Examples:

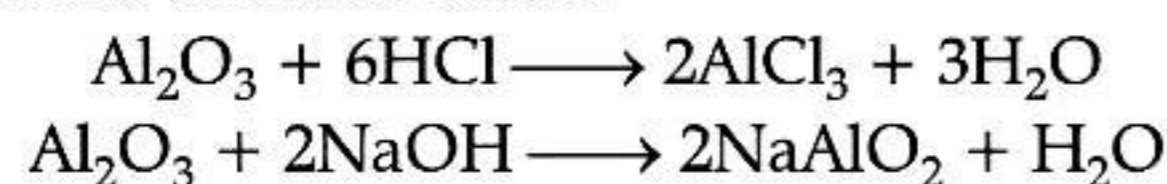


Q. 4. Which of the following is amphoteric in nature ?

- (A) Both aluminium oxide and zinc oxide
 (B) Only zinc oxide
 (C) Only aluminium oxide
 (D) Neither of them.

Ans. Option (A) is correct.

Explanation: Aluminium oxide reacts with hydrochloric acid to produce aluminium chloride (salt) and behaves as basic oxide. Similarly, it also reacts with sodium hydroxide (base) to produce sodium aluminate (salt) and behaves as acidic oxide.



Zinc oxide reacts with hydrochloric acid to produce zinc chloride and behaves as basic oxide. Similarly, it also reacts with sodium hydroxide to produce sodium zincate and behaves as acidic oxide.

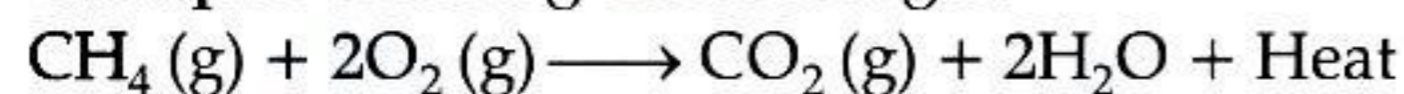
Q. 5. The reaction in which heat is generated is called as:

- (A) Exothermic reaction
 (B) Endothermic reaction
 (C) Decomposition reaction
 (D) Precipitation reaction

Ans. Option (A) is correct.

Explanation: Reaction in which heat is released along with formation of products are called exothermic reactions.

Example: Burning of natural gas.



III. Read the following and answer any four questions from Q.1. to Q.5.

Sohan 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 sad but after a futile argument, the man beat a hasty retreat.

Q. 1. Which of the following is used for dissolution of gold?

- (A) Hydrochloric acid (B) Sulphuric acid
 (C) Nitric acid (D) Aqua regia

Ans. Option (D) is correct.

Explanation: Aqua Regia is a mixture of concentrated HNO_3 and concentrated HCl . It is used for dissolution of gold.

Q. 2. The composition of aqua-regia is

- (A) Dil. HCl : Conc. HNO_3 3: 1

(B) Conc. HCl : Dil. HNO_3 3: 1

(C) Conc. HCl : Conc. HNO_3 3: 1

(D) Dil. HCl : Dil. HNO_3 3: 1

Ans. Option (C) is correct.

Explanation: Aqua regia is a mixture of nitric acid and hydrochloric acid, that is 3 part conc. HCl and one part conc. HNO_3 (3 : 1).

Q. 3. Which of the following is incorrect?

- (A) Aqua regia is a strong oxidising agent.
 (B) Aqua regia is a strong reducing agent.
 (C) Aqua regia dissolves gold in it.
 (D) Aqua regia is a mixture of hydrochloric acid and nitric acid.

Ans. Option (B) is correct.

Explanation: Aqua Regia is a strong oxidizing agent due to the formation of NOCl (Nitrosyl chloride) and chlorine produced by reaction of two acids.

Q. 4. Aqua regia dissolves:

- (A) Gold and platinum
 (B) Gold and silver
 (C) Platinum and silver
 (D) Only gold

Ans. Option (A) is correct.

Explanation: Aqua Regia is a mixture of concentrated HNO_3 and concentrated HCl . Concentrated HNO_3 acts as a very strong oxidising agent which ionises Au atoms and Concentrated HCl produces nascent chlorine which in turn reacts with ionised Au atoms thus forming auric chloride.

Q. 5. Examples of Noble metals are:

- (A) Gold (B) Silver
 (C) Platinum (D) All of the above

Ans. Option (D) is correct.

Explanation: The noble metals are a group of metals that resist oxidation and corrosion in moist air. The noble metals are not easily attacked by acids. Gold, silver and copper are noble metals.

IV. Read the following and answer any four questions from Q.1. to Q.5.

During extraction of metals, electrolytic refining is used to obtain pure metals. During the process, the impure metal is made the anode and a thin strip of pure metal is made the cathode. The solution of the metal salt is used as an electrolyte. On passing the current through the electrolyte, the pure metal from the anode dissolves from the electrolyte. An equivalent of pure metal from the electrolyte is deposited on the cathode.

Q. 1. The process of purification of the metal obtained after reduction, is called:

- (A) Extraction (B) Refining
 (C) Froth floatation (D) Electrolysis

- (B) Electronegativity decreases down the group due to decrease in tendency to lose electrons.
 (C) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.
 (D) Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons.

Ans. Option (C) is correct.

Explanation: Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.

Q. 5. Which of the following reason correctly justifies that "Fluorine (72pm) has smaller atomic radius than Lithium (152pm)"?

- (A) F and Li are in the same group. Atomic size increases down the group
 (B) F and Li are in the same period. Atomic size increases across the period due to increase in number of shells
 (C) F and Li are in the same group. Atomic size decreases down the group
 (D) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

Ans. Option (D) is correct.

Explanation: F and Li are in the same period and across the period atomic size/radius decreases from left to right.

VI. In a thermite reaction, a compound of iron reacts with a metal.

Q. 1. The metal used is:

- (A) Zinc (B) Aluminium
 (C) Magnesium (D) None of these.

Ans. Option (B) is correct.

Explanation: Aluminium (Al) is used in thermite process. Al is the reducing agent.

Q. 2. After completion of this reaction, a metal is obtained in the molten state. Identify the metal:

- (A) Zinc (B) Aluminium
 (C) Iron (D) Magnesium

Ans. Option (C) is correct.

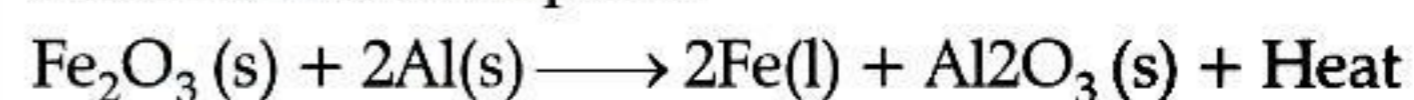
Explanation: Al reacts with oxygen to form aluminium oxide (Al_2O_3) which is amphoteric in nature.

Q. 3. The correct equation to justify thermite reaction is:

- (A) $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 - \text{Heat}$.
 (B) $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 + \text{Heat}$.
 (C) $\text{Al}_2\text{O}_3 + 2\text{Fe} \rightarrow 2\text{Al} + \text{Fe}_2\text{O}_3 + \text{Heat}$.
 (D) $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$.

Ans. Option (B) is correct.

Explanation: In the thermite process, iron (III) oxide is heated with aluminium, which results in evolution of high amount of heat which melts iron. This molten iron is used to fill the cracked machine parts.



Q. 4. The correct name for Fe_2O_3 is:

- (A) Ferrous oxide (B) Ferric oxide
 (C) Ferrous hydroxide (D) Ferric hydroxide

Ans. Option (B) is correct.

Explanation: The correct name for Fe_2O_3 is ferric oxide.

