

Class 10 Chapter 3 Metals and Non-Metals Important Questions with Answers

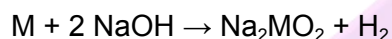
Short Answer Type Questions

Q1. Iqbal treated a lustrous, divalent element M with sodium hydroxide. He observed the formation of bubbles in the reaction mixture. He made the same observations when this element was treated with hydrochloric acid. Suggest how can he identify the produced gas. Write chemical equations for both reactions.

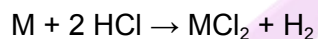
Answer:

The gas that is liberated is hydrogen gas. To check the presence of hydrogen gas, we can bring a burning matchstick near the evolved gas if the matchstick burns with a pop sound. It confirms the evolution of hydrogen gas.

Reaction with NaOH:



Reaction with HCl:



Q2. During the extraction of metals, electrolytic refining is used to obtain pure metals.

- (a) Which material will be used as anode and cathode for refining silver metal in this process?
- (b) Suggest a suitable electrolyte also.
- (c) Where do we get pure silver in this electrolytic cell after passing an electric current?

Answer:

- (a) During electrolytic refining, impure metal is used as anode and pure metal is used as cathode. So, impure silver will be used as an anode, and pure silver will be used as a cathode.
- (b) Silver sulphate or Silver nitrate solution can be an appropriate electrolyte.
- (c) We will obtain pure silver on the cathode because metals are electropositive.

Q3. Why should the metal sulphides and carbonates be converted to metal oxides in the extraction process of metal?

Answer:

It is easier to obtain metals from their oxides than carbonates or sulphides. So, the ore is first converted into an oxide. A carbonate ore is first converted into oxide ore by calcination. Sulphide ore is converted into oxide ore by roasting.

Q4. 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?

Answer:

Most metals do not react with HNO_3 because nitric acid is a potent oxidising agent. Hence, when metals (except Mn and Mg) are treated with nitric acid, hydrogen gas is not liberated. Only magnesium and manganese can produce hydrogen gas with very dilute nitric acid.

Q5. Compound X and aluminium are used to join railway tracks.

- (a) Identify the compound X.
- (b) Name the reaction.
- (c) Write down its reaction.

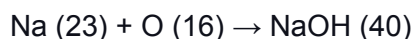
Answer:

- (a) Compound X is ferrous oxide (Fe_2O_3).
- (b) This reaction is called a thermite reaction.
- (c) $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 + \text{heat}$

Q6. When a metal X is treated with cold water, it gives a basic salt Y with the molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y and Z and also write the reaction involved.

Answer:

X is Na because the molecular mass of NaOH is 40.



Hence,

- X is Sodium.
- Y is Sodium hydroxide.
- Z is hydrogen, which catches fire when it reacts with water.



Here oxygen is losing hydrogens, so it is oxidised. The Na has gained oxygen, so it is reduced.

Therefore, it is a redox reaction and an H_2 displacement reaction. Redox reactions are reactions in which one species is reduced and another is oxidised. Consequently, the oxidation state of the species involved must change.

Q7. A non-metal X exists in two different forms, Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Answer:

X is carbon. Diamond and graphite are allotropes of carbon. Diamond is the hardest natural substance, and hence Y is diamond. Graphite is a good conductor of electricity, and hence Z is graphite.

Q8. The following reaction takes place when the aluminium powder is heated with MnO_2



(a) Is aluminium getting reduced?

(b) Is MnO_2 getting oxidised?

Answer:

(a) No, aluminium is not getting reduced.

(b) No, MnO_2 is not getting oxidised.

In this reaction, aluminium gets oxidised as oxygen gets combined with it. Since oxygen is removed from MnO_2 , it is getting reduced.

Q9. What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires?

Answer:

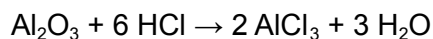
Lead and tin are the constituents of the solder alloy. Solder alloy has a low melting point, making it suitable for welding electrical wires.

Q10. A metal A, which is used in the 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 HI and NaOH.

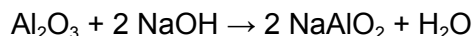
Answer:

Metal A is aluminium, and B is aluminium oxide (Al_2O_3).

The reaction of aluminium oxide with HCl



The reaction of aluminium oxide with NaOH:

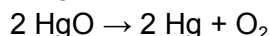
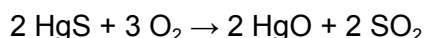


Q11. A metal that exists as a liquid at room temperature is obtained by heating its sulphide in the presence of air. Identify the metal and its ore and give the reaction involved.

Answer:

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

The reactions are as follows



Q12. Give the formulae of the stable binary compounds that would be formed by the combination of the following pairs of elements.

(a) Mg and N₂

(b) Li and O₂

(c) Al and Cl₂

(d) K and O₂

Answer:

(a) Magnesium nitride (Mg₃N₂)

(b) Lithium oxide (Li₂O)

(c) Aluminium chloride (AlCl₃)

(d) Potassium oxide (K₂O)

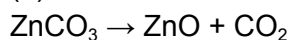
Q13. What happens when

(a) ZnCO₃ is heated without oxygen?

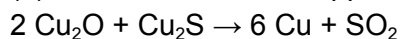
(b) A mixture of Cu₂O and Cu₂S is heated?

Answer:

(a) When zinc carbonate is heated without oxygen, we get zinc oxide and carbon dioxide.



(b) When a mixture of copper oxide and copper sulphide is heated. We get the pure copper.



Q14. A non-metal A is an important constituent of our food and forms two oxides, B and C. Oxide B is toxic. In contrast, C causes global warming

(a) Identify A, B, and C

(b) To which Group of Periodic Table does A belong?

Answer:

(a) A is Carbon. B is Carbon monoxide, and C is Carbon-dioxide.

(b) Carbon belongs to Group 14.

16. Give two examples of the metals that are good conductors and poor conductors of heat, respectively.

Answer:

Iron and copper are good conductors of heat and electricity.

Lead and mercury are poor conductors of heat and electricity.

Q17. Name one metal and one non-metal that exist in the liquid state at room temperature. Also, name two metals having a melting point of less than 310 K (37°C)

Answer:

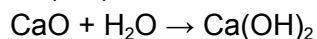
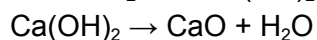
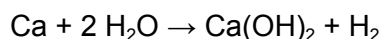
Mercury (metal) and bromine (non-metal) exist in the liquid state at room temperature. Caesium and gallium are metals with a melting point of less than 310 K.

Q18. An element A reacts with water to form a compound B used in whitewashing. The compound B on heating forms an oxide C which gives back B on treatment with water. Identify A, B and C and give the reactions involved.

Answer:

- A is calcium. It reacts with water to give calcium hydroxide.
- B is calcium hydroxide. It is used for whitewashing.
- C is calcium oxide.

The reactions are as follows:



Q19. An alkali metal A gives a compound B (molecular mass = 40) on reacting with water. The compound B gives a soluble compound C on treatment with aluminium oxide. Identify A, B and C and give the reaction involved.

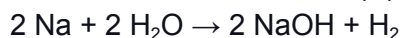
Answer:

Given

- $x + 16 + 1 = 40$
- $x = 40 - 17 = 23$

It is the atomic weight of sodium.

Therefore, the alkali metal (A) is sodium, and the reaction is



So, compound B is sodium hydroxide (NaOH).

Sodium hydroxide reacts with aluminium oxide (Al_2O_3) to give sodium aluminate (NaAlO_2). Thus, C is sodium aluminate (NaAlO_2). The reaction involved is

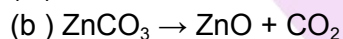
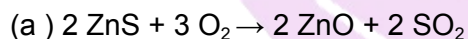


Hence

- A is sodium
- B is sodium hydroxide
- C is sodium aluminate

Q20. Give the reaction involved during extraction of zinc from its ore by

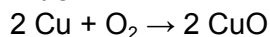
- (a) Roasting of zinc ore
- (b) Calcination of zinc ore

Answer:

Q21. A metal M does not liberate hydrogen from acids but reacts with oxygen to give a black colour product. Identify M and black coloured products and explain M's reaction with oxygen.

Answer:

Copper does not react with acids. But copper gives black coloured copper oxide when it reacts with oxygen. Hence, M is copper, and the black coloured product is copper oxide.



Q22. An element forms an oxide A_2O_3 which is acidic in nature. Identify A as metal or non-metal.

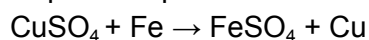
Answer:

Oxides of non-metals are acidic. Hence, A is a non-metal.

Q23. We kept a solution of CuSO_4 in an iron pot. After a few days, the iron pot was found to have several holes in it. Explain the reason in terms of reactivity. Write the equation of the reaction involved.

Answer:

Iron is more reactive than copper. Due to this, iron displaced copper from copper sulphate to form iron sulphate. A portion of the iron pot got dissolved, causing holes in it.



Long Answer Type Questions

Q1. A non-metal A, the largest constituent of air, when heated with H_2 in a 1:3 ratio in the presence of a catalyst (Fe), gives a gas B. On heating with O_2 , it gives an oxide C. If this oxide is passed into the water in the presence of air, it gives an acid D which acts as a strong oxidising agent.

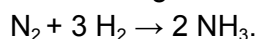
(a) Identify A, B, C, and D

(b) To which group of periodic tables does this non-metal belong?

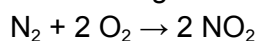
Answer:

(a) A is nitrogen; because nitrogen is the largest constituent of air. B is ammonia, C is nitrogen dioxide, and D is nitric acid (a potent oxidising agent).

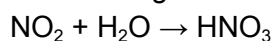
When nitrogen is heated with hydrogen in the presence of a catalyst, the following reaction occurs.



When nitrogen is heated with oxygen, we get nitrogen dioxide.



When nitrogen dioxide is treated with water, we get nitric acid.



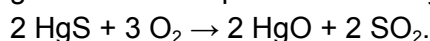
(b) This non-metal belongs to Group 15.

Q2. Give the steps involved in extracting low and medium reactivity metals from their respective sulphide ores.

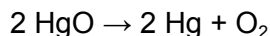
Answer:

When low and medium reactivity metals are extracted, an individual sulphide ore is first heated in the air. This helps in obtaining the oxide of the metal. It is easier to extract a metal from its oxide than sulphide.

Mercury is a metal of low reactivity. Mercury sulphide (cinnabar) is heated in the air. Mercury sulphide gets oxidised to produce mercury oxide.

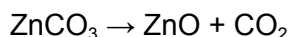
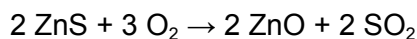


After that, mercury oxide is reduced to obtain mercury.

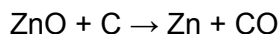


Zinc is a metal of medium reactivity. It is found as a zinc blende (ZnS).

Zinc blende is roasted to be converted into zinc oxide. Zinc spar is put under calcination to be converted into zinc oxide.



Zinc oxide obtained is reduced to zinc metal by heating with carbon (a reducing agent).



Q3. Explain the following

- (a) Reactivity of Al decreases if it is dipped in HNO_3
- (b) Carbon cannot reduce the oxides of Na or Mg
- (c) NaCl is not a conductor of electricity in solid-state, whereas it does conduct electricity in aqueous solution as well as in the molten state
- (d) Iron articles are galvanised.
- (e) Metals like Na, K, Ca and Mg are never found in their free state in nature.

Answer:

- (a) When aluminium is dipped in nitric acid, a layer of aluminium oxide is formed on the metal. It happens because nitric acid is a potent oxidising agent. The layer of aluminium oxide prevents further reaction of aluminium.
- (b) Sodium and magnesium tend to react with oxygen rather than carbon because sodium and magnesium are highly reactive metals. Hence, carbon cannot reduce the oxides of sodium and magnesium.
- (c) Ionic compounds do not conduct electricity in a solid-state but conduct in an aqueous and molten state due to the presence of free electrons. This property is shown by sodium chloride.
- (d) Iron articles are galvanised to prevent them from rusting because, after galvanisation, the layer of zinc works as a protective layer.
- (e) Metals such as Na, K, Ca and Mg are highly reactive metals, and hence they are not found in their free state.

Q4. (i) Given below are the steps for extraction of copper from its ore.

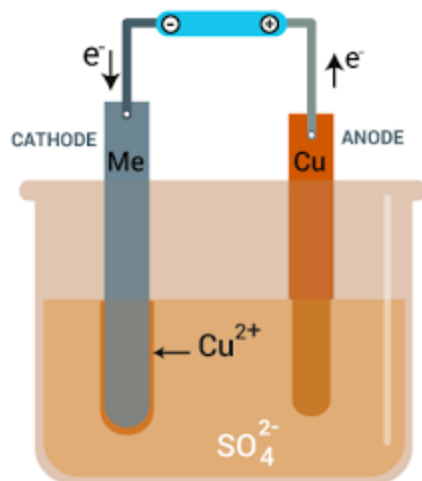
Write the reaction involved.

- (a) Roasting of copper (1) sulphide
- (b) Reduction of copper (1) oxide with copper (1) sulphide.
- (c) Electrolytic refining.

Draw a neat and well labelled diagram for electrolytic refining of copper.

Answer:

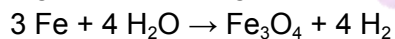
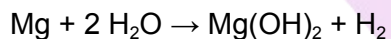
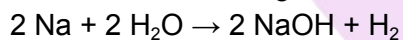
- (a) $2 \text{Cu}_2\text{S} + 3 \text{O}_2 \rightarrow 2 \text{Cu}_2\text{O} + 2 \text{SO}_2$
 (b) $2 \text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightarrow 6 \text{Cu} + \text{SO}_2$
 (c) At cathode: $\text{Cu}^{2+} + 2 \text{e}^- \rightarrow \text{Cu}$



Q5. Of the three metals, X, Y and Z. X react with cold water, Y with hot water and Z with steam. Identify X, Y and Z and also arrange them in order of increasing reactivity.

Answer:

X is sodium, Y is magnesium, and Z is iron.



Their sequence in reactivity series is: $\text{Fe} < \text{Mg} < \text{Na}$.

Q6. An element A burns with golden flame in the air. It reacts with another element B, atomic number 17, to give a product C. An aqueous solution of product C on electrolysis gives a compound D and liberates hydrogen. Identify A, B, C and D. Also, write down the equations for the reactions involved.

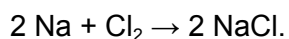
Answer:

Element A is sodium metal (Na) as it burns with a golden flame.

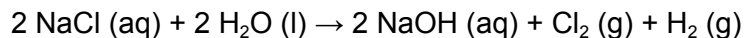
Element B with atomic number 17 is chlorine (Cl).

Sodium and chlorine combine to form sodium chloride, NaCl(compound C).

We can write the reaction as



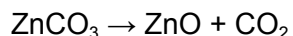
An aqueous solution of NaCl on electrolysis gives the compound D, sodium hydroxide(NaOH). We can write the reaction as



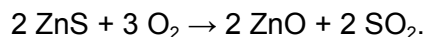
Q7. Two ores A and B were taken. On heating, ore A gives CO, whereas ore B gives SO₂. What steps will you take to convert them into metals?

Answer:

A carbonate ore is calcinated to obtain the oxide of the metal. When a carbonate ore is heated, we get carbon dioxide. The following equation shows the calcination of zinc carbonate.



When a sulphide ore is roasted, we get Sulphur dioxide. Zinc sulphide is roasted to obtain zinc oxide.



After any of the above steps, zinc oxide is reduced to obtain pure zinc.

