

Metals And Non-metals

Multiple Choice Questions

Question 1.

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

- A. Electrical conduction
- B. Sonorous in nature
- C. Dullness
- D. Ductility

Answer:

Metals generally do not show dullness. Metals such as gold and silver usually are shiny rather than dull.

Question 2.

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

- A. ductility
- B. malleability
- C. sonorousity
- D. conductivity

Answer:

The ability of metals to be drawn into thin wire is called ductility. It is one such property of metals that is used to make wires from metals. Metals such as copper have high ductility and thus can be drawn into long and thin wires without breaking.

Question 3.

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

- (i) Good thermal conductivity
- (ii) Good electrical conductivity
- (iii) Ductility

(iv) High melting point

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

Answer:

Aluminium has good thermal conductivity and high melting point. As a good conductor of heat, it helps in heat transfer and cooking of food. With the high melting point, one can cook food in such utensils at higher temperatures and the aluminium utensils can withstand such higher temperatures without being melted by the heat.

Question 4.

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

- A. Na
- B. Ca
- C. Mg
- D. Fe

Answer:

Na (sodium) and Ca (calcium) react with water vigorously. Mg (Magnesium) reacts with water less vigorously than that of calcium and sodium. Fe (Iron), on the other hand, does not react with cold as well as hot water instantly. But when the iron is kept in contact with water for a long time, rusting of iron happens.

Question 5.

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

- A. FeO
- B. Fe₂O₃
- C. Fe₃O₄
- D. Fe₂O₃ and Fe₃O₄

Answer:

When steam is passed over iron for a long time, it gives iron oxide (Fe₃O₄) and hydrogen gas.



Question 6.

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. (ii) and (iv)

Answer:

When calcium is treated with water, it reacts with water vigorously and to produce a cloudy white precipitate of calcium hydroxide and hydrogen gas is released as bubbles.



Sometimes hydrogen bubbles get stuck to the surface of calcium metal making it light and thus calcium starts floating. This reaction is exothermic in nature.

Question 7.

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

- A. H₂SO₄
- B. HCl
- C. HNO₃
- D. All of these

Answer:

does not give hydrogen gas on reacting with metals. Nitric acid is a strong oxidizing agent. It oxidizes hydrogen produced in the reaction to water and nitric acid itself is reduced to any of these nitrogen oxides [N_2O (nitrous oxide), NO (nitric oxide) or NO_2 (nitrogen dioxide)]. On the contrary, magnesium and manganese reacts with dilute nitric acid to give salt and hydrogen gas.

Question 8.

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

Answer:

Aqua-regia is a mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio of 3:1. Aqua-regia being a very strong acid dissolves gold in it.

Question 9.

Which of the following are not ionic compounds?

(i) KCl

(ii) HCl

(iii) CCl_4

(iv) NaCl

A. (i) and (ii)

B. (ii) and (iii)

C. (iii) and (iv)

D. (i) and (iii)

Answer:

Non-ionic compounds are those that have covalent bonds. Hydrochloric acid (HCl) and carbon tetrachloride (CCl₄) form covalent due to sharing of a pair of electrons between two atoms. Whereas sodium chloride (NaCl) and potassium chloride (KCl) form ionic compounds as they consist of positive and negative ions.

Question 10.

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

- A. Solubility in water
- B. Electrical conductivity in solid state
- C. High melting and boiling points
- D. Electrical conductivity in molten state

Answer:

In solid state, ions in ionic compounds are not free to move. Thus, such compounds do not show electrical conductivity in solid state. Whereas, in molten state, ions are free to move and hence conduct electricity.

Question 11.

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)

Answer:

Gold (Au) and silver (Ag) are not reactive or very less reactive. These metals are called noble metals. Thus, these are placed at the bottom of the reactivity series. Since gold and silver are least reactive of all the metals, these are found in free state in nature.

Question 12.

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)

Answer:

Gold (Au) and copper (Cu) obtained after extraction is in impure form. So, metals Au (gold) and Cu (copper) are refined by electrolytic refining. Other than gold and copper, electrolytic refining is used for metals such as Zn and Ag. Sodium (Na) and potassium (K) are extracted by electrolytic reduction. Metals obtained after electrolytic reduction are in pure form.

Question 13.

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

A. Ag_3N

B. Ag_2O

C. Ag_2S

D. Ag_2S and Ag_3N

Answer:

Silver articles turn black after prolonged exposure to air due to the reaction of sulphur present in air. Silver reacts with sulphur to form dark grey to black silver sulphide.

Question 14.

Galvanisation is a method of protecting iron from rusting by coating with a thin layer of

A. Gallium

B. Aluminium

- C. Zinc
- D. Silver

Answer:

Coating iron or steel with a layer of zinc prevents it from rusting. This process is called galvanization. Water pipes are also galvanized to protect them from corrosion.

Question 15.

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

- A. Ni and Cr
- B. Cu and Cr
- C. Ni and Cu
- D. Cu and Au

Answer:

Alloying elements enhance the structure and properties such as durability, strength and toughness of the metal. It makes them corrosion resistant. Stainless steel is an alloy of iron, nickel and chromium.

Question 16.

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

- A. CuSO_4
- B. CuCO_3
- C. $\text{Cu}(\text{NO}_3)_2$
- D. CuO

Answer:

Copper gets green coating due to the formation of a mixture of copper carbonate and copper hydroxide when it reacts with carbon dioxide gas and moisture present in air. This is called tarnishing of copper.

The reaction is as follows:



Question 17.

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

A. Na

B. Fe

C. Cr

D. Hg

Answer:

Mercury (Hg) is the only metal which is found in liquid state at room temperature. All other metals are solid at room temperature. It also has the lowest melting point.

Question 18.

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)

Answer:

Sodium and calcium are very reactive metals and are placed towards the top of the reactivity series. These are produced by the electrolysis of their molten chlorides. The metal ions are deposited at negatively charged cathode and chlorine is deposited at positively charged anode.

Question 19.

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

A. Sulphur

B. Oxygen

C. Nitrogen

D. Iodine

Answer:

Iodine is a non-metal that is lustrous. Graphite is another non-metal that is shiny and lustrous.

Question 20.

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

A. Mg

B. Ag

C. Zn

D. Cu

Answer:

Ag (silver) would be displaced from the solution of its salts by other three metals, i.e., magnesium (Mg), zinc (Zn) and copper (Cu). Silver (Ag) is a noble metal and is least reactive metal among other metals given.

Question 21.

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

A. Al

B. Au

C. Cu

D. Pt

Answer:

Explanation: Test tube C contains chemical mixture called aqua-regia. It is a mixture of concentrated HCl and concentrated HNO₃ in the ratio of 3:1. Aqua-regia dissolves gold and platinum in it while hydrochloric acid and nitric acid do not.

Question 22.

An alloy is

- A. an element
- B. a compound
- C. a homogeneous mixture
- D. a heterogeneous mixture

Answer:

An alloy is a homogeneous mixture. Alloy is a homogeneous mixture of two or more metals. For example, brass is an alloy of copper and zinc. Stainless steel is an alloy made with combination of iron with chromium with nickel.

Question 23.

An electrolytic cell consists of

- (i) positively charged cathode
 - (ii) negatively charged anode
 - (iii) positively charged anode
 - (iv) negatively charged cathode
- A. (i) and (ii)

B. (iii) and (iv)

C. (i) and (iii)

D. (ii) ad (iv)

Answer:

An electrolytic cell consists of positively charged anode and negatively charged cathode. Positively charged ions (cations) are deposited at negatively charged cathode. Negatively charged ions (anions) are deposited at positively charged anode.

Question 24.

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

Answer:

During electrolytic refining of zinc, it gets deposited on cathode. Since, zinc ions are positively charged, it gets deposited at the negatively charged cathode.

Question 25.

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

Answer:

Na (sodium) possesses all the above properties. It is too soft and can be cut with a knife. It is also very reactive and reacts with oxygen or moisture present in air and produce sodium hydroxide which is highly exothermic reaction producing a lot of heat. It also reacts with water vigorously and burns due to the formation of hydrogen gas. That is why sodium is stored in kerosene oil to prevent any reaction.

Question 26.

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

Answer:

Steel contains non-metal as one of its constituents. Steel is an alloy made by combining iron and other elements mainly carbon. Carbon gives strength to iron. It is used to make buildings, ships, automobiles, machines, appliances.

Question 27.

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

Answer:

Magnesium metal reacts with cold water to form magnesium oxide and evolves hydrogen gas is an incorrect statement. Magnesium when reacts with water gives magnesium hydroxide and hydrogen gas. Reaction of metals and water generally produce hydrogen gas and their respective hydroxide. For example, sodium metal reacts with water to produce sodium hydroxide and liberates hydrogen gas.

Question 28.

Which among the following alloys contains mercury as one of its constituents?

- A. Stainless steel
- B. Alnico
- C. Solder
- D. Zinc amalgam

Answer:

Zinc amalgam contains mercury as one of its constituents. An alloy of mercury with another metal is called amalgam. Almost all metals except iron, platinum, tungsten, and tantalum can form amalgams with mercury. Amalgams of silver and mercury are important in dentistry. Amalgams of gold and mercury are used in the extraction of gold from its ore.

Stainless steel: An alloy of Fe and C

Alnico: An alloy of Al, Ni and Co

Solder: An alloy of Pb and Sn

Question 29.

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

- A. Has high melting point
- B. Has low melting point
- C. Conducts electricity in molten state

D. Occurs as solid

Answer:

Compound Z does not show the property of “Has low melting point”. As compound Z is formed because of transfer of electrons between X and Y, hence Z is an ionic compound. Such compounds do not have low melting point. Bonds in ionic compounds are very strong. Therefore, a lot of energy is needed to break them. This is the reason why ionic compounds have high melting and boiling points.

Question 30.

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

- A. X is a metal
- B. Y is a metal
- C. Z is a non-metal
- D. Y is a non-metal and Z is a metal

Answer:

Atomic number of X is 10, so this must be Ne (Neon), a noble or inert gas. This gas has octate configuration.

Atomic number of Y is $2 + 8 + 7 = 17$, so this must be chlorine (Cl). Chlorine is a non-metal. Non-metals have 5 to 7 electrons in their valence shell.

Atomic number of Z is $2 + 8 + 2 = 12$, so this must be Magnesium (Mg). Magnesium is a metal. Metals have 1 or 2 electrons in their valence shell.

Question 31.

Although metals form basic oxides. Which of the following metals form an amphoteric oxide?

- A. Na
- B. Ca
- C. Al
- D. Cu

Answer:

Al (aluminium) forms amphoteric oxides. An amphoteric oxide acts both as an acid and as a base.

Question 32.

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

A. Diamond

B. Graphite

C. Sulphur

D. Fullerene

Answer:

Graphite is a good conductor of electricity and heat. Graphite has weak intermolecular forces between its layers. Hence it has de-localised electrons. As electrons are free to move through its structure, it conducts heat and electricity well.

Question 33.

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

Answer:

Electrical wires have a coating of an insulating material called PVC (Polyvinylchloride). PVC is a polymer and bad conductor of electricity. It is the most common insulating material used to insulate electrical conductors from electric charge thus preventing human contact with live electricity.

Graphite is good conductor of electricity. Hence it cannot be used as insulating material.

Sulphur, although is a bad conductor of electricity, but is brittle in nature. So, cannot be used as insulating material.

Question 34.

Which of the following non-metals is a liquid?

A. Carbon

- B. Bromine
- C. Phosphorus
- D. Sulphur

Answer:

Bromine, a non-metal, is a liquid. Metals are generally solid whereas non-metals can be solid, liquid and gas. Bromine is a non-metal that exists as liquid.

Question 35.

Which of the following can undergo a chemical reaction?

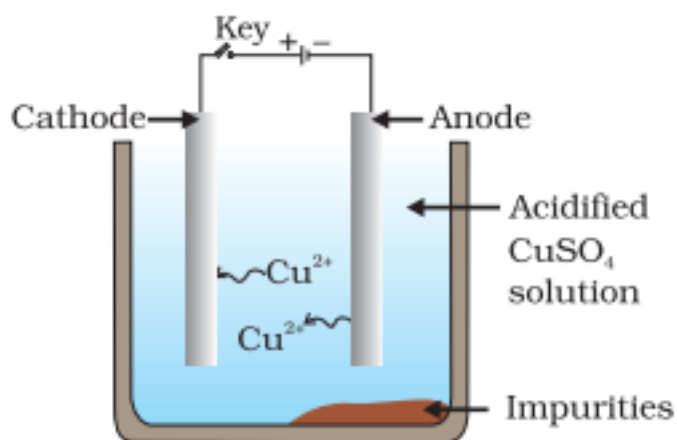
- A. $\text{MgSO}_4 + \text{Fe}$
- B. $\text{ZnSO}_4 + \text{Fe}$
- C. $\text{MgSO}_4 + \text{Pb}$
- D. $\text{CuSO}_4 + \text{Fe}$

Answer:

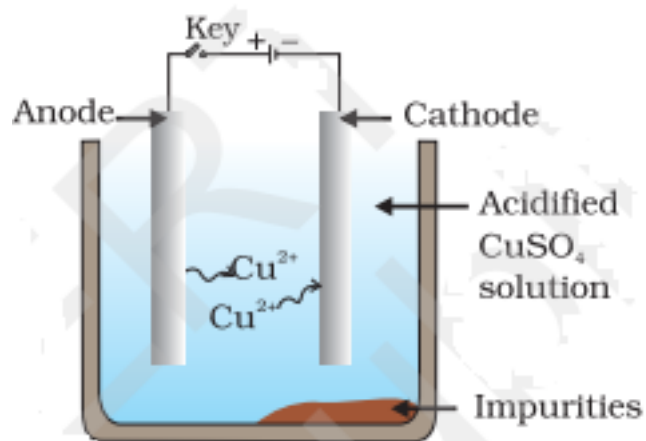
$\text{CuSO}_4 + \text{Fe}$ can undergo a chemical reaction. As iron metal is more reactive than copper metal, iron displaces copper from copper sulphate solution and forms aqueous iron sulphate (FeSO_4) and solid copper (Cu). This is a single displacement reaction also known as a substitution reaction. The iron can be solid or aqueous but the copper sulphate must be aqueous in order to facilitate the reaction.

Question 36.

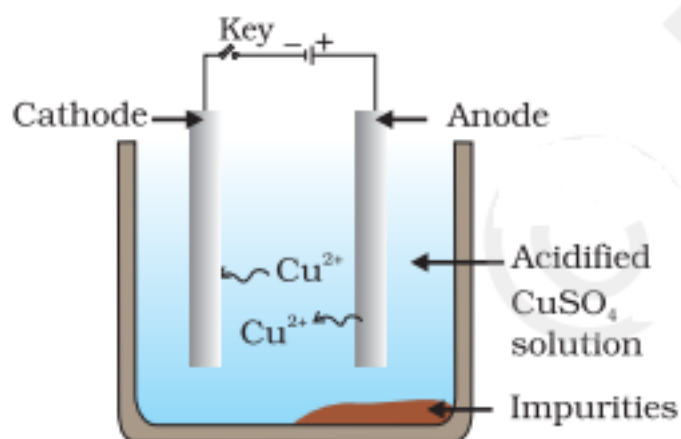
Which one of the following figures correctly describes the process of electrolytic refining?



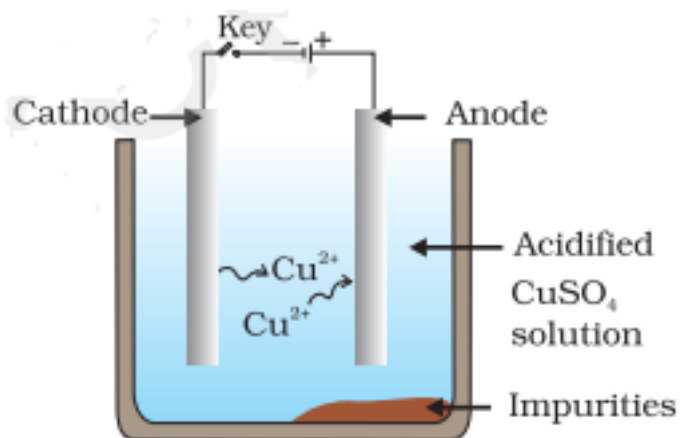
A.



B.



C.



D.

Answer:

Figure (c) correctly describes the process of electrolytic refining.

In the process of electrolytic refining, impure metal (calcium) forms the positively charged anode whereas pure metal forms the negatively cathode. Copper sulphate (CuSO_4) is taken as an electrolyte.

Figure (c) shows the process of electrolytic refining of copper metal. Copper from impure anode dissolves into the solution. Copper ions (Cu^{2+}) from the solution are deposited on the cathode.

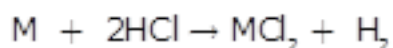
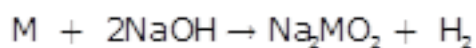
Short Answer Questions

Question 1.

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

Answer:

The lustrous, divalent element must be a metal. Metals that are very reactive react with sodium hydroxide readily and bubbles are produced due to formation of hydrogen gas. When a burning candle is brought near the reaction vessel, a pop sound is produced.



Question 2.

During extraction of metals, electrolytic refining is used to obtain pure metals. (a) Which material will be used as anode and cathode for refining of silver metal by this process? (b) Suggest a suitable electrolyte also. (c) In this electrolytic cell, where do we get pure silver after passing electric current?

Answer:

(a) Impure silver is taken as anode. Pure silver is taken as cathode.

(b) Suitable electrolyte is any silver salt such as AgNO_3 .

(c) We get pure silver at cathode.

In the process of electrolytic refining of silver, impure metal (impure silver) forms the positively charged anode whereas pure metal (pure silver) forms the negatively cathode. Silver nitrate (AgNO_3) is taken as an electrolyte. Silver from impure anode dissolves into the solution. Silver ions from the solution are deposited on the cathode.

Question 3.

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

Answer:

Extraction of a metal from its oxide is easier as compared to its extraction from its sulphides and carbonates. Metals occur in the form of its ores. An ore is a mineral from which metal can be extracted. Ores found in the form of carbonates and sulphides are first converted into their oxides by the process of calcination and roasting. Oxides thus obtained are converted to metals by the process of reduction. Later metals are purified by various purification methods.

Question 4.

Generally, when metals are treated with mineral acids, hydrogen gas is liberated but when metals (except Mn and Mg), treated with HNO_3 , hydrogen is not liberated, why?

Answer:

Nitric acid (HNO_3) is a strong oxidising agent. When a metal reacts with dilute nitric acid hydrogen gas is released. Nitric acid oxidises the hydrogen (H_2) to water (H_2O) and itself gets reduced to NO_2 or NO or N_2O . So, no hydrogen gas is evolved in this case.

Question 5.

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) X is Fe_2O_3 .

(b) The name of the reaction is thermite reaction. This is a redox reaction between aluminium and iron (III) oxide that produces molten iron as aluminium is more reactive metal than iron. This reaction is highly exothermic and heat is produced.

(c) $\text{Fe}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s}) \rightarrow 2\text{Fe}(\text{l}) + \text{Al}_2\text{O}_3(\text{s}) + \text{Heat}$

Question 6.

When a metal X is treated with cold water, it gives a basic salt Y with 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, Y is NaOH and Z is H_2

The reaction is : $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 + \text{Heat Energy}$

Since the molecular formula of Y = XOH, let's suppose the atomic weight of metal X is a. Then, molecular mass of XOH = $a + 16 + 1 = 400$.

Then, $a = 400 - 17 = 383$. The atomic weight of sodium is 23, so metal X is sodium (Na). Sodium reacts with water to give hydrogen gas (Z) that catches fire.

So, metal X is sodium (Na), Y is (sodium hydroxide) and Z is H_2 (hydrogen gas).

Question 7.

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.

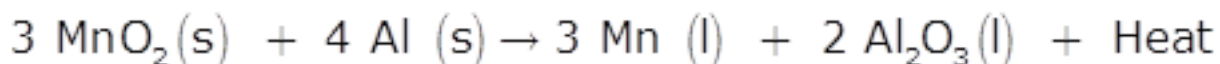
Answer:

Here, X is Carbon, Y is Diamond Z is Graphite.

Non-metal X is carbon (C). Carbon exists in two different forms. These different forms of carbon are called the allotropes of carbon. Diamond and graphite are allotropes of carbon. Y is diamond because diamond is the hardest natural substance. Z is graphite as it is a good conductor of electricity.

Question 8.

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



(a) Is aluminium getting reduced?

(b) Is MnO_2 getting oxidised?

Answer:

(a) No, aluminium is getting oxidized as oxygen is added to it to form aluminium oxide.

(b) No, manganese is getting reduced as it has lost its oxygen.

Since aluminium is more reactive than manganese, it displaces manganese from its oxide. Aluminum accepts oxygen from manganese dioxide. It reduces the manganese dioxide to manganese and aluminum oxide is formed.

Question 9.

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

Answer:

Solder is an alloy made from the combination of lead and tin. It is used for welding electric wires because it has a low melting point.

Question 10.

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.

Answer:

The metal A is Aluminum , B is Al_2O_3

The reaction is:



Metal A is aluminium (Al) that is used in the thermite process. Al reacts with oxygen to form aluminium oxide [Al_2O_3 (B)], which is amphoteric in nature. Thus, aluminium oxide reacts both as a base and as an acid.

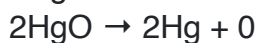
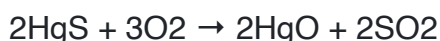
Question 11.

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 liquid at room temperature. It is placed low in reactivity series and can be obtained by reducing their sulphides or oxides by heating. It can be obtained by heating the sulphide ore of mercury called cinnabar (HgS).

The reactions are as follows:

**Question 12.**

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

- (a) Mg and N₂
- (b) Li and O₂
- (c) Al and Cl₂
- (d) K and O₂

Answer:

A formulae is the representation of compounds in terms of symbols of its various elements.

- (a) Mg and N₂ reacts to form Mg₃N₂ (magnesium nitride).
- (b) Li and O₂ reacts to form Li₂O (lithium oxide).
- (c) Al and Cl₂ reacts to form AlCl₃ (aluminium chloride).
- (d) K and O₂ reacts to form K₂O (potassium oxide).

Question 13.

What happens when

- (a) ZnCO₃ is heated in the absence of oxygen?
- (b) a mixture of Cu₂O and Cu₂S is heated?

Answer:

(a) When zinc carbonate is heated in the absence of oxygen, zinc oxide and carbon dioxide are produced. The process of reduction carbonate ores to form oxides in absence of oxygen is called calcination. Zinc is found in its ore – zinc carbonate. When this ore is heated, zinc oxide is formed along with carbon dioxide.



(b) When a mixture of copper oxide and copper sulphide is heated, pure copper is obtained. It undergoes auto reduction. When sulphide ore of copper is heated, a part of this ore is converted into oxide which then reacts with remaining sulphide ore to give pure copper and sulphur dioxide.

**Question 14.**

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.

- (a) Identify A, B and C.
- (b) To which Group of periodic table does A belong?

Answer:

(a) A is carbon (C) as it is an important constituent of our food, B is carbon monoxide (CO) as it is highly poisonous and toxic and C is carbon dioxide (CO₂) as it is the main cause of global warming.

(b) A belongs to Group 14 of the periodic table. It has atomic number 6. Its electronic configuration is 2, 4.

Question 15.

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

Answer:

Metals in general, are conductors of heat. Some are good conductors whereas some are poor conductors of heat. Owing to the number of free electrons they have, they are classified into good or poor conductors of heat. Those metals that have more number of free electrons are good conductors and those that have less number of free electrons are poor conductors of heat.

- (a) Ag (Silver) and Cu (Copper) are good conductors of heat.
- (b) Pb (Lead) and Hg (Mercury) are poor conductors of heat.

Question 16.

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°C).

Answer:

A metal that exists in liquid state at room temperature is mercury (Hg). A non-metal that exists in liquid state at room temperature is bromine (Br).

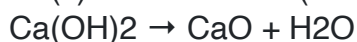
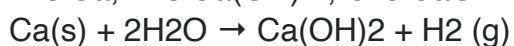
Two metals with melting points less than 310K (37°C) are Cesium (Cs) and Gallium (Ga).

Question 17.

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

Answer:

A is Ca, B is Ca(OH)_2 , C is CaO



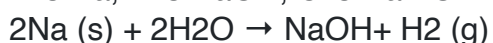
Element A is calcium (Ca). When calcium reacts with water, it forms calcium hydroxide [Ca(OH)_2]. Calcium hydroxide is used in white washing. Thus compound B is calcium hydroxide [Ca(OH)_2]. Compound B on heating gives oxide of calcium (CaO). Thus, C is calcium oxide (CaO). Calcium oxide (CaO) on treatment with water gives back B [Ca(OH)_2].

Question 18.

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:

A is Na, B is NaOH, C is NaAlO_2



Let 's suppose the atomic weight of alkali metal A be x. When it reacts with water, it forms a compound B having molecular mass 40.

$$\text{Therefore, } x + 16 + 1 = 40$$

$$x = 40 - 17 = 23$$

The atomic weight of Na (sodium) is 23.

Therefore, the alkali metal (A) is Na. Sodium reacts with water to form sodium hydroxide.

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).

Question 19.

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

- (a) roasting of zinc ore
- (b) calcination of zinc ore

Answer:

- (a) $2\text{ZnS (s)} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2 \text{ (g)}$
- (b) $\text{ZnCO}_3 \text{ (s)} \rightarrow \text{ZnO (s)} + \text{CO}_2 \text{ (g)}$

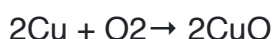
Zinc is commonly extracted from its ore called zinc blende also known as zinc sulphide (ZnS). Firstly, froth flotation process removes gangue from sulphide ores. During roasting, the concentrated ore is finely ground and made to react with a stream of air. This converts zinc blende to zinc oxide (ZnO) which is more reactive. During calcination, the carbonate ore is heated strongly in the absence of air to convert it into metal oxide.

Question 20.

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.

Answer:

The metal M is Cu and the black coloured product is copper oxide (CuO). Copper does not react with acids but reacts with oxygen to form copper oxide. The reaction of metal M with oxygen is as follows:

**Question 21.**

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

Answer:

Non-metallic oxides are acidic in nature. Therefore, A is a non-metal.

Question 22.

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.

Answer:

We know that iron is more reactive than copper. Hence, iron displaced copper from copper sulphate solution. This reaction is called displacement reaction. Due to displacement, there is formation of holes in the iron pot. The following equation shows this reaction.



Long Answer Questions

Question 1.

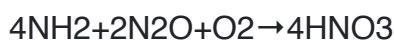
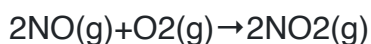
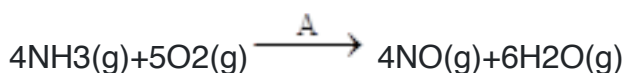
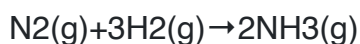
A non-metal A which is the largest constituent of air, when heated with H_2 in 1:3 ratio in the presence of catalyst (Fe) gives a gas B. On heating with O_2 it gives an oxide C. If this oxide is passed into water in the presence of air it gives an acid D which acts as a strong oxidising agent.

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

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

Answer:

The non-metal A is nitrogen (N_2). It forms the largest constituent of air, i.e., 78%. When N_2 is heated with H_2 in 1:3 ratio in presence of iron (Fe) as catalyst, it forms ammonia gas (NH_3). This is known as Haber process. Thus the gas B is ammonia. When ammonia is heated with O_2 , it forms nitric oxide (NO). NO further gets oxidized to NO_2 by O_2 . Thus, oxide C is NO_2 (nitrogen dioxide). When this oxide reacts with water in the presence of air (O_2), it gives nitric acid. Thus acid D is nitric acid which is a strong oxidizing agent. The chemical reactions involved are as follows:



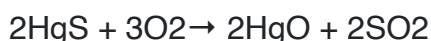
(b) Nitrogen belongs to Group 15 of periodic table because nitrogen has 5 valence electrons (electronic configuration is of N is 2, 5).

Question 2.

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

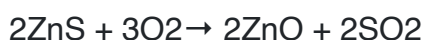
Answer:

Extraction of metals of low reactivity: Mercury is a less reactive metal. The ore of mercury is called cinnabar, i.e. mercury (II) sulphide. The ore is heated in air and is oxidized to produce mercury (II) oxide. Mercury oxide is reduced to obtain mercury. The following reactions are involved in this process.



Extraction of metals of medium reactivity: The metals in the middle of the reactivity series are also extracted by roasting followed by the process of reduction but the methods are somewhat different. Let's take the example of zinc.

Extraction of Zinc: Zinc is placed in the middle of the reactivity series. It occurs as zinc blende (zinc oxide). It is first heated in the presence of air to obtain zinc oxide. This process is shown by following equation:



After that, zinc oxide is reduced to obtain pure zinc metal. The reduction is done in the presence of carbon. This can be shown by following equation.

**Question 3.**

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 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 (Al) is dipped in nitric acid (HNO₃), a layer of aluminium oxide is formed on the metal. This happens because nitric acid is a strong oxidizing agent. The layer of aluminium oxide prevents further reaction of aluminium. This is the reason why the reactivity of aluminium decreases.

(b) Sodium and magnesium have tendency to react with oxygen rather than carbon because these are highly reactive metals. Hence, carbon cannot reduce the oxides of Na or Mg.

(c) Ionic compounds do not conduct electricity in solid state but they conduct electricity in aqueous solution and in molten state due to high concentration of free electrons. This property is shown by sodium chloride as it is an ionic compound.

(d) Iron articles are galvanized to prevent them from rusting. After galvanization, the layer of zinc works as protective layer. The most common type is hot-dip galvanizing. In this process, iron parts are submerged in a bath of molten zinc.

(e) Metals such as Na, K, Ca and Mg are highly reactive metals and hence they are not found in their free state in nature.

Question 4.

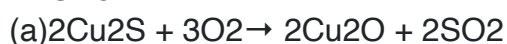
(i) Given below are the steps for extraction of copper from its ore. Write the reaction involved.

(a) Roasting of copper (I) sulphide

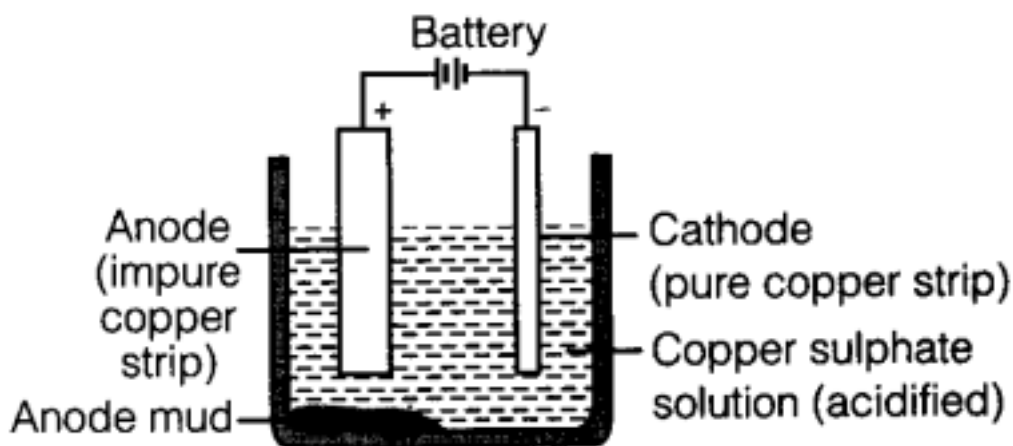
(b) Reduction of copper (I) oxide with copper (I) sulphide.

(c) Electrolytic refining

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

Answer:

(ii)



Question 5.

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

Answer:

Metal X is sodium. Metal Y is magnesium. Metal Z is iron.

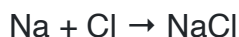
Order in reactivity series: $\text{Na} > \text{Mg} > \text{Fe}$

Question 6.

An element A burns with golden flame in 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 that burns with golden flame. Element B is chlorine. Its atomic number is 17. Product C is sodium chloride. Compound D is sodium hydroxide. When sodium reacts with chlorine, it gives sodium chloride.



Electrolysis of sodium chloride gives sodium hydroxide.



Question 7.

Two ores A and B were taken. On heating ore A gives CO₂ whereas, ore B gives SO₂. What steps will you take to convert them into metals?

Answer:

When carbonate ore (ore A) is heated, it produces carbon dioxide. A carbonate ore undergoes calcination to give metal oxide. For example, zinc carbonate undergoes calcination to give zinc oxide.



When a sulphide ore (ore B) is heated, it produces sulphur dioxide. A sulphide ore undergoes roasting to give metal oxide. For example, zinc sulphide undergoes roasting to give zinc oxide.



After calcination or roasting, zinc oxide should be reduced to obtain zinc. ZnO is a white powdery substance and is insoluble in water.

