3 Metals and Non-metals

IMPORTANT NOTES

1. **Element** is a substance which cannot be further subdivided into simpler substances by any physical or chemical means.
2. **Metals** are the elements (except hydrogen) which form positively charged ions by losing electrons from their valence shell and form oxides which are basic in nature.
3. **Non-metals** are the elements which form negatively charged ions by accepting electrons in their valence shell and form acidic or neutral oxides.
4. **All metals** have one to three electrons in their valence shell.
5. **All non-metals** have four to seven electrons in their valence shell.
6. **Physical Properties of Metals**

   Metals generally : (i) are solids, (ii) are hard, (iii) have lustre, (iv) have high densities, (v) have high melting and boiling points, (vi) are malleable, (vii) are ductile, (viii) have high tensile strength, (ix) are good conductors of heat and electricity, (x) are monoatomic, (xi) and can form alloys.
7. **Physical Properties of Non-metals**

   Non-metals generally : (i) are brittle solids or gases, (ii) are soft, (iii) have low densities, (iv) have no lustre, (v) have low melting and boiling points, (vi) are not malleable, (vii) are not ductile, (viii) have no tensile strength, (ix) are bad conductors of heat and electricity, (x) are polyatomic, (xi) do not form alloys.
8. **Chemical Properties of Metals :**
   (i) Metals generally react with oxygen to form their oxides which are **basic in nature**.
   (ii) Metal oxides of aluminium, zinc, lead and tin react with alkalises as well as acids. Such oxides are called **amphoteric oxides**.
   (iii) Active metals like potassium, sodium, calcium, magnesium, aluminium, zinc and iron react with water or steam to form their hydroxides/oxides and hydrogen gas.
   (iv) Active metals react with dilute mineral acids to form their respective salts and hydrogen gas.
   (v) Active metals displace less active metals from their aqueous salt solutions. The reaction which takes place is called chemical displacement reaction.
   (vi) A table of metals arranged in the order of their decreasing chemical reactivity, is called metal reactivity series.
9. **Chemical Properties of Non-metals**
   (i) Non-metals generally react with oxygen to form their oxides, which are either neutral or acidic in nature.
   (ii) Neutral oxides of non-metals are CO, NO, H_2O and N_2O.
   (iii) Non-metals do not displace hydrogen from water or dilute mineral acids.
   (iv) Non-metals react with one another to form covalent compounds.
   (v) Non-metals react with metals to form ionic compounds.
10. An atom or an ion having duplet or octet configuration like noble gases is said to be in the ***minimum state of energy*** and hence is ***chemically inactive.***
11. The atoms of an element can attain stable electronic configuration of the nearest noble gas :
    (i) by donating (losing) one or more electrons from their valence shell to another atom,
    (ii) by accepting (gaining) one or more electrons in their valence shell from another atom,
    (iii) by sharing electrons from their valence shell with another atom/atoms.
12. The atom which accepts or donates electron/ electrons from its valence shell so as to acquire a configuration of the nearest noble gas gets electrically charged and becomes an ***ion***.

13. The ***metals*** generally ***donate electrons*** from their valence shell and hence form ***positively charged ions.*** These positively charged ions are called ***cations,*** because, they discharge at the ***cathode*** to form neutral atoms.

14. The ***non-metals*** generally ***accept electrons*** in their valence shell and hence form ***negatively charged ions.*** The negatively charged ions are called ***anions***, because, they discharge at the ***anode*** to form neutral atoms.

15. Characteristics of Cations :

(i) Only metals form cations, because, they have 1 to 3 electrons in their valence shell which they can easily donate to acquire a stable configuration of the nearest noble gas.

(ii) There is no change in atomic number of an element as it forms a cation, because, the number of protons do not change.

(iii) The atomic radii of a cation is smaller than neutral atom, because of the disappearance of the valence shell.

16. Characteristics of Anions :

(i) Only non-metals form anions, because, they have 4 to 7 electrons in their valence shell. Thus, they accept electrons in their valence shell to acquire a stable configuration of the nearest noble gas.

(ii) There is no change in the atomic number of an anion as the number of protons in it are the same as in the neutral atom.

(iii) The atomic radii of an anion slightly increases, because the effective pull of the nucleus slightly decreases due to addition of extra electron/electrons in the valence shell.

17. Electropositive elements : The elements which have a tendency to donate electrons from their valence shell and become positively charged ions (cations) are called ***electropositive elements***. All metals and hydrogen are electropositive elements.

$$E - e^- \longrightarrow E^+$$

(from valence shell)

Metal — Cation

18. Electronegative elements : The elements which have a tendency to accept electrons in their valence shell and become negatively charged ions (anions) are called ***electronegative elements***. All non-metals are electronegative elements.

$$E + e^- \longrightarrow E^-$$

(into valence shell)

Non-metal — Anion

19. Electrovalent bond or Ionic bond : A chemical bond formed between two different atoms, by the transfer of one or more electrons from the valence shell of an electropositive or metallic element to the valence shell of a non-metallic element, is called an ***electrovalent bond*** or an ***ionic bond***.

20. Electrovalency : The number of electrons which an atom of an element donates or accepts in its valence shell, so as to have a stable configuration like that of the nearest noble gas is called ***electrovalency.***

21. Electropositive valency : The number of electrons which an atom of an element (metal or hydrogen) donates from its valence shell, so as to have a stable configuration like that of a noble gas, is called ***electropositive valency.***

22. Electronegative valency : The number of electrons which an atom of an element (non-metal) accepts in its valence shell, so as to have a stable configuration like that of a noble gas is called ***electronegative valency.***

23. Electrovalent compound or Ionic compound: The chemical compound formed as a result of transfer of electrons from the valence shell of an atom (metal or hydrogen) of an element to the valence shell of an atom of another element (non-metal) is called ***electrovalent compound or ionic compound***.

24. Properties of Electrovalent (ionic) Compounds :

(i) They are generally hard and crystalline solids.

(ii) They are generally non-volatile and hence have high melting and boiling points.

(iii) They are good conductors of electricity in the fused state.

(iv) They are generally soluble in water and their aqueous solutions are good conductors of electricity.

(v) The chemical reaction between the aqueous solutions of ionic compounds is very fast.

25. **Metallurgy** encompasses various processes in the extraction of a metal from its ore and then refining the metal including study of its properties and uses.

26. **Gangue or Matrix** are the unwanted impurities, such as sand, stones, mud, limestone, mica, etc. associated with the naturally occurring ore.

27. **Dressing of ore** involves processes, (such as hand picking, grinding and crushing and pulverizing) which give an ore such a physical form, so that gangue can be easily removed from the ore.

28. **Concentration of ore** involves processes, which help in the removal of gangue from the dressed ore, thereby increasing the concentration of the metal in the ore.

29. **Electromagnetic separation** is the concentration process followed for the dressed ore, if

(i) the ore is magnetic in nature.

(ii) ore contains magnetic impurities (such as Fe_2O_3).

30. **Gravity process or Hydraulic washing method** of concentration is followed for such dressed ores which have metallic ores of high density as compared to the density of gangue. It is not followed in case of sulphide ores.

31. **Froth floatation** process for the concentration is followed for sulphide ores only. In this process, the sulphide ore is immersed in a mixture of pine oil and water and then strongly agitated with compressed air. The sulphide ore rises up along with the froth produced by the oil, but the gangue sinks to the bottom.

32. **Chemical method for the concentration of ore** is followed for such ores (ore of aluminium), in which density of the ore and the gangue is almost same.

33. **Calcination** is the process of heating the concentrated ore in the absence of air, such that it decomposes to form its metallic oxide.

Following are the objectives achieved during calcination:

(i) removes moisture from the ore

(ii) makes the ore porous

(iii) expels the volatile impurities

(iv) decomposes carbonate ores to oxide ores.

34. **Roasting** is the process of heating the concentrated ore (only sulphide ores) in the presence of excess of air, such that it changes to the oxide ore.

Following are the objectives achieved during roasting :

(i) removes moisture from the ore

(ii) makes the ore porous

(iii) expels the volatile impurities

(iv) oxidises sulphide ores to oxide ores.

35. **Smelting or reduction of ore** is the process of conversion of the metal oxide ore into metal, by reducing it with a suitable reducing agent. The reducing agents commonly used are coke, carbon monoxide and hydrogen. For reducing ores of highly active metals, electrolytic reduction is employed.

36. **Refining of metals** is done by a number of methods. However, the best method is electrolytic method. In this method the pure metal is made the cathode, and the impure metal is made the anode. The cathode and the anode are immersed in the aqueous solution of metal. On the passage of electric current, the pure metal from the anode is transferred to the cathode.

37. **Thermite mixture** consists of three parts of ferric oxide and one part of powdered aluminium. It is commonly employed in spot welding, such as broken railway lines.

38. **Alloy** is a homogeneous mixture of two or more metals, obtained by melting them together.

39. (a) Major alloys of aluminium are

(i) ***Duralumin or Dural***
[A1 = 95%; Cu = 4%; Mn = 0.5%; Mg = 5%]

(ii) ***Magnalium*** [Al = 95%; Mg = 5%]

(b) Major alloys of iron are

(i) ***Stainless steel***
[Fe = 73% – 80%; C = 1.0%; Cr = 18%; Ni = 1%]

(ii) ***Manganese steel***
[Fe = 83% – 84%; Mn = 15%; C = 1% – 1.5%]

(iii) ***Tungsten steel***

[Fe = 79% – 85%; W = 10% – 20%; C = 1%] and

(iv) **Alnico**

[Fe = 60%; Al = 12%; Ni = 20%, Co = 5%]

(c) Major alloys of copper are :

(i) ***Aluminium bronze*** [Cu = 90%; Al = 10%]

(ii) ***Brass*** [Cu = 60% – 80%; Zn = 20% – 40%]

(iii) ***Bronze*** [Cu = 80%; Zn = 10%; Sn = 10%]

(iv) ***Gun metal*** [Cu = 88%; Sn 10%; Zn = 1% – 2%] and

(v) ***German silver***

[Cu = 30% – 60%; Zn = 25% – 35%; Ni = 15% – 35%].

40. **Gold** is alloyed with metals like copper, silver, cadmium, so as to make it hard and workable at low temperature.

41. **Purity of gold** is measured in carats. 100% pure gold is 24 carat, while 1 carat = 4.1666 g per 100 g of alloy.

42. **Corrosion of metals** is the formation of layers of undesirable compounds on the surface of metals due to the action of moist air containing impurities.

43. **Corrosion of metal** take place only, if the surface of metal comes in direct contact with moist air for prolonged time.

44. **Rusting :** The slow conversion of iron into hydrated ferric oxide in the presence of moist air is called rusting.

45. **Rust** is a flaky, non-sticky brown powder formed on the surface of iron, when the iron is exposed to moist air.

46. **Factors which promote rusting :** In addition to moist air : (i) the presence of salts such as sodium chloride, (ii) presence of more active metals than iron and the presence of pollutants such as NO_2; SO_2; CO_2 in air, promote rusting.

47. **Rusting can be prevented by** coating the metal surface with (i) red lead (ii) paints (iii) enamel (iv) oil or grease (v) plastic coating (vi) galvanising (vii) tinning (viii) electroplating with nickel or chromium (ix) converting iron into stainless steel.

ASSIGNMENTS FOR SUMMATIVE ASSESSMENT

I. VERY SHORT ANSWER QUESTIONS (1 Mark)

A. IMPORTANT QUESTIONS

1. Name two acidic non-metallic oxides.

2. Name a non-metal which is highly tensile.

3. Name a non-metal which forms positively charged ions.

4. Name two metals whose density is less than 1 gcm^{-3}.

5. Name a naturally occurring non-metal, which is the hardest substance.

6. Name a metal which does not react with conc. nitric acid.

7. 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? **[HOTS]**

8. Amongst the metals, non-metals and noble gases, to which category do the element belong if they have : (i) positive valency; (ii) negative valency; (iii) zero valency.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Why do silver ornaments loose their shine when kept for some time? **[2010 (T-1)]**

2. Name a metal other than aluminium that is covered with an oxide film layer. **[2010 (T-1)]**

3. Name one metal and one non-metal which exists in liquid state at room temperature? **[2010 (T-1)]**

4. Name a non-metal which is lustrous and a

metal which is non-lustrous. **[2010 (T-1)]**

5. Name two metal which have very low melting point. **[2010 (T-1)]**

6. If copper metal is heated over a flame, it develops a coating. What is the colour and composition of this coating? **[2010 (T-1)]**

7. Why is sodium metal kept immersed in kerosene oil? **[2010 (T-1)]**

8. Name one metal which react with very dilute HNO_3 to evolve hydrogen gas. **[2010 (T-1)]**

9. 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. **[2010 (T-1)]**

10. An element A form two oxides AO and AO_2. The oxide AO is neutral whereas the oxide AO_2 is acidic in nature. Would you call element A a metal or non-metal. **[2010 (T-1)]**

11. In the refining of silver the recovery of silver from silver nitrate solution involves displacement by copper metal. Give the reason for the same. **[2010 (T-1)]**

12. Name two metals which are both ductile as well as malleable. **[2005, 2006, 2010 (T-1)]**

13. The reaction of iron (III) oxide Fe_2O_3 with aluminium is used to join cracked iron parts of machines. **[2008]**

14. Give reason for the following:

(a) Ionic compounds conduct electricity in the molten state. **[2008]**

15. Give reason for the following :

Metals can be given different shapes according to our needs. **[2008]**

16. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal? **[2008]**

17. Which reducing agent is used in the reduction of alumina? **[2007]**

18. What are metalloids? **[2006]**

19. Why are titanium and chromium classified as strategic metals? **[2006]**

20. Which one of the following metals does not react with oxygen even at high temperatures?

(i) Calcium (ii) Gold (iii) Sodium **[2006]**

21. Give reasons for the following :

Addition of some silver to pure gold for making ornaments. **[2006]**

22. Give reason for the following:

Alumina is dissolved in molten cryolite for electrolysis to obtain aluminum metal. **[2006]**

23. Write the chemical equation to represent the reaction taking place between sodium metal and cold water. **[2005]**

24. Why is tungsten metal selected for making filaments of incandescent lamp bulbs? **[2005]**

25. Name a metal which offer higher resistance to the passage of electricity than copper. **[2005]**

26. Write the chemical equation for the reaction of hot aluminium with steam. **[2005]**

27. How does the metal magnesium differ from the metal calcium in their reaction with water? **[2005]**

28. What is seen to happen when a piece of sodium metal is dropped into water? **[2005]**

II. SHORT ANSWER QUESTIONS–I (2 Marks)

A. IMPORTANT QUESTIONS

1. Describe briefly the froth floatation process for the concentration of sulphide ores.

2. What is a thermite reaction?

3. Does every mineral have a definite and fixed composition? Explain.

4. What important properties of aluminium are responsible for its great demand in the industry?

5. Why is iron more useful when it is mixed with a little carbon?

6. What is 24 carat gold? How will you convert it into 18 carat gold?

7. Name the alloy of :

(i) aluminium in the construction of aircrafts,

(ii) lead used in joining metal for electrical work,

(iii) copper used in household vessels.

8. Zinc is higher in the electrochemical series than iron, yet it is used for preventing the rusting of iron. Explain.

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

(a) roasting of zinc ore

(b) calcination of zinc ore

10. Explain the following : **[HOTS]**

(i) Iron articles are galvanised.

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

11. What happen when **[HOTS]**

(a) $ZnCO_3$ is heated in the absence of oxygen?

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

12. What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires? **[HOTS]**

13. Name two metals which displace hydrogen from strong caustic alkalises. Write chemical equations in support of your answer.

14. Name two non-metals which occur in :
(i) solid state, (ii) gaseous state.

15. What kind of oxide is ZnO? Support your answer by writing two chemical equations.

16. Name one metal which : (i) displaces copper,
(ii) does not displace copper, from copper nitrate solution.

17. What happens when iron is placed in copper sulphate solution?

18. State the reactions if any of the following metals reacts with ferrous sulphate solution :
(i) zinc, (ii) copper, (iii) silver.

19. A metal P is placed in an aqueous solution of Q. In a few hours metal Q was deposited on metal P. Which metal amongst P and Q is more reactive and why?

20. Write chemical equations for the following reactions.

(i) Aluminium and hydrochloric acid

(ii) Magnesium and steam

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Aluminium occurs in combined state whereas gold is found in free state. Why? **[2010 (T-1)]**

2. Most metals do not react with bases, but zinc metal does. Suggest a reason. Write an equation for the reaction between Zn and NaOH. **[2010 (T-1)]**

3. Write chemical equations for the reactions taking place when **[2010 (T-1)]**

(i) zinc sulphide is heated in air

(ii) calcination of zinc carbonate is done.

4. How pure copper is obtained from impure copper by electrolytic refining? **[2010 (T-1)]**

5. 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,Z. **[2010 (T-1)]**

6. Write the equations for the following metals which are obtained from their compounds by reduction process. **[2010 (T-1)]**

(i) Metal X which is low in reactivity series.

(ii) Metal Y which is middle of series.

7. Explain, why most of the metals do not displace hydrogen from Nitric acid. **[2010 (T-1)]**

8. Explain, why calcium metal after reacting with water starts floating on its surface? Write the chemical equation for the reaction. **[2010 (T-1)]**

9. Name the chemicals used in the acid fire extinguisher and the gas evolved from it when used? **[2010 (T-1)]**

10. State reasons for the following :

(i) Electric wires are covered with rubber-like material.

(ii) From dilute hydrochloric acid zinc can liberate hydrogen gas but copper cannot. **[2009]**

11. State reasons for the following observations:

(i) The shining surface of some metals becomes dull when exposed to air for a long time.

(ii) Metals sulphides occur mainly in rocks but metal halides occur mostly in sea and lake. **[2009]**

12. Differentiate between roasting and calcination processes used in metallurgy. Give an example of each. **[2008]**

13. Give reason for the following:

(a) Gold and silver are used to make jewellery.

(b) Carbonate and sulphide ores are usually converted into oxides prior to reduction during the process of extraction. **[2008]**

14. With a labelled diagram describe an activity to show that metals are good conductors of electricity. **[2008]**

15. Name an alloy

(i) Which has a lower melting point than its constituents.

(ii) Which is more hard, tough and strong than its constituents. **[2007]**

16. Define the term 'alloy'. Write two advantages of making alloys. **[2007]**

17. State reasons for the following:

(i) Metals are good conductors of heat

(ii) Inability of non-metals for displacing hydrogen from dilute sulphuric acid. **[2006]**

18. Choose the metal (from the list given below) which can displace zinc from zinc sulphate solution-Lead, Copper, Magnesium, Silver.

Write the equation of the chemical reaction involved. **[2006]**

19. A copper plate was dipped into a solution of $AgNO_3$. After sometime, a black layer was deposited on the copper plate. State the reason for it. Write the chemical equation of the reaction involved. **[2006]**

III. SHORT ANSWER QUESTIONS-II (3 Marks)

A. IMPORTANT QUESTIONS

1. 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 the reactions. **[HOTS]**

2. 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. **[HOTS]**

3. Give one example of an article made from iron which is protected from rusting by:

(i) red lead paint (ii) enamelling

(iii) plastic coating (iv) tinning

(v) electroplating (vi) oiling or greasing

4. During extraction of metals, electrolytic refining is used to obtain pure metals. **[HOTS]**

(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?

5. Compound X and aluminium are used to join railway tracks. **[HOTS]**

(a) Identity the compound X

(b) Name the reaction

(c) Write down its reaction.

6. Give the steps involved in the extraction of metals of low and medium reactivity from their respective sulphide ores. **[HOTS]**

7. (i) Why is gold alloyed? Give two reasons.

(ii) Name two metals which are commonly used for alloying gold.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Most metals do not react with bases but zinc metal does. Suggest a reason and write an equation for the reaction between zinc and NaOH. **[2010 (T-1)]**

2. A magnesium ribbon is burnt in oxygen to give a white compound X accompanied by emission of light.

(a) Write the chemical formulae of X

(b) Write a balanced chemical equation, when X is dissolved in water. **[2010 (T-1)]**

3. Metal compound A reacts with dilute hydrochloric acid and to produce effervescence. The gas evolved extinguishers a burning candle and turns the limewater milky. Write balanced chemical equations for the reactions. **[2010 (T-1)]**

4. (a) Why metals are not found in their free state generally?

(b) If a strip of aluminium with scratched clean surface is dipped into an aqueous

solution of copper sulphate for little time, surface of the strip becomes brownish. What is the reason for this? Write the balanced chemical equation for the reaction. **[2010 (T-1)]**

5. (a) What type of reaction is to be performed to ascertain and verify the position of metals in the reactivity series?

(b) If an iron nail immersed in the aqueous solution of copper sulphate, what are the changes happening to the nail and to the solution?

(c) Write the balanced chemical equation for the reaction between iron metal and aqueous copper sulphate solution. **[2010 (T-1)]**

6. (a) Using a simple experiment, how can you prove that magnesium is placed above zinc in reactivity series? **[2010 (T-1)]**

(b) Why copper metal cannot liberate hydrogen when reacting with dil. HCl?

7. Give reasons for the following : **[2009]**

(i) Zinc oxide is considered as an amphoteric oxide.

(ii) Non-metals in general do not displace hydrogen from dilute acids.

(iii) Metals conduct electricity.

8. An ore on heating in air produces sulphur dioxide. Which process would you suggest for its concentration? Describe briefly any two steps involved in the conversion of this concentrated ore into the related metal. **[2009]**

9. What is meant by 'rusting'? With labelled diagrams describe an activity to find out the conditions under which iron rusts. **[2009]**

10. Give reasons for the following observations:

(i) Ionic compounds in general have high melting and boiling points

(ii) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.

(iii) Copper vessels get a green coat when left exposed to air in the rainy season. **[2009]**

11. Name two metals which react violently with cold water. Write any three observations you would make when such a metal is dropped into water. How would you identify the gas evolved, if any, during the reaction? **[2008]**

12. (a) Give an example of a metal which **[2008]**

(i) can be easily cut with a knife

(ii) is a liquid at room temperature.

(b) Write chemical equation for the reaction when

(i) steam acts on red hot iron

(ii) zinc is added to iron (II) sulphate solution.

13. (a) Name a metal for each case :

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

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

(b) 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? **[2008]**

14. (a) Name the chief ore of iron. Write its formula.

(b) How is an iron ore concentrated? Describe it briefly. **[2007]**

15. Give reasons for the following :

(i) Metals are regarded as electropositive elements.

(ii) When a piece of copper metal is added to a solution of zinc sulphate no change takes place, but the blue colour of copper sulphate fades away when a piece of zinc is placed in its solution.

(iii) Articles made of aluminium do not corrode even though aluminium is an active metal. **[2006]**

16. (i) Explain the term 'roasting' as used in metallurgical processes. Give one suitable example for it.

(ii) What changes take place when cinnabar (HgS) is heated in air for a long enough time? **[2006]**

17. Explain the following terms by giving one example of each: (i) Mineral (ii) Ore (iii) Gangue **[2006]**

18. Give reasons for each of the following:

(i) Germanium is called a metalloid.

(ii) Zirconium is known as a strategic metal.

(iii) Nitrogen is used to preserve food. **[2005]**

IV. LONG ANSWER QUESTIONS (5 Marks)

A. IMPORTANT QUESTIONS

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 **[HOTS]**

(a) Identify A, B, C and D

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

2. What is galvanised iron? How is iron galvanised? What is the advantage of galvanised iron? How does galvanised iron get its name? State its two uses.

B. QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Write the names and symbols of two most reactive metals. Explain drawing electric structure how any one of the two metals react with a halogen. State any two physical properties of the compound formed. **[2010 (T-1)]**

2. State the reason why? **[2010 (T-1)]**

(i) carbon is not used to reduce the oxides of sodium or aluminium.

(ii) an iron strip dipped in a blue copper sulphate solution turns the blue solution pale green.

(iii) metals replace hydrogen from acids whereas non-metals do not.

(iv) calcium does not occur free in nature.

(v) zinc is used in the galvanisation of iron and not the copper.

3. (a) Write the electron dot structures of sodium, oxygen and magnesium

(b) Show the formation of Na_2O and MgO by transfer of electrons

(c) Give three properties of ionic compounds. **[2010 (T-1)]**

4. (a) Describe the steps associated with extraction of copper from its sulphate ore.

(b) How impure copper is purified by electrolytic refining? **[2010 (T-1)]**

5. (a) Name the main ore of mercury. How mercury is obtained from its ore? Give balanced chemical equations.

(b) What is thermit reaction? How it is used to join the railway tracks or cracked machine parts?

(c) Name the method used to extract metals of high reactivity. **[2010 (T-1)]**

6. (a) Name the components of the alloy steel and stainless steel.

(b) Why gold is alloyed with copper?

(c) Name a metal which

(i) will react vigorously with cold water.

(ii) will react with only hot water.

(iii) will only react with steam.

(iv) will not react with water oreven with steam. **[2010 (T-1)]**

7. (a) Write the balanced chemical equations for the extraction of copper metal from its ore. What is the reducing agent used?

(b) Which reducing agent can be used in the extraction of metals placed in the top of the reactivity series? Give the name of the process also.

(c) What is the chemical formed as green coating when copper reacts with atmospheric gases in moist conditions?

(d) What is galvanisation? **[2010 (T-1)]**

8. (a) What are the main two allotropes of carbon? Distinguish between these two allotropes on the basis of hardness and electrical conduction.

(b) Why aluminium articles have a longer life and attractive finish compared to many other metals?

(c) Explain the following terms

(i) ore (ii) gangue

(d) What is common feature in the electronic configuration of metal atoms? **[2010 (T-1)]**

9. A metal E is stored under kerosene. When a small piece of it is left open in the air, it catches fire. When the product formed is dissolved in water it turns red litmus to blue :

(i) Name the metal E.

(ii) Write the chemical equation for the reaction when it is exposed to air and when the product is dissolved in water.

(iii) Explain the process by which the metal is obtained from its molten chloride.

[2010 (T-1)]

10. Write balanced chemical equation for the reactions taking place when

(i) Zinc carbonate is calcinated.

(ii) Zinc sulphate is roasted.

(iii) Zinc oxide is reduced in the zinc.

(iv) Cinnabar is heated in the air.

(v) Manganese dioxide is heated with aluminium powder. **[2010 (T-1)]**

11. (a) What are ionic compounds? List any four physical properties of these compounds.

(b) What reaction happens when manganese dioxide is heated with aluminium powder? In which physical state is the metal produced in this reaction and why? **[2009]**

12. (a) Distinguish between ionic and covalent compounds under the following properties:

(i) Strength of forces between constituent elements.

(ii) Solubility of compounds in water.

(iii) Electrical conduction in substances

(b) Explain how the following metals are obtained from their compounds by the reduction process:

(i) Metals M which is in the middle of the reactivity series.

(ii) Metal N which is high up in the reactivity series.

Give one example of each type. **[2009]**

13. (a) What is an 'activity series' of metals? Arrange the metals Zn, Mg, Al, Cu and Fe in the decreasing order of reactivity.

(b) What would you observe when you put

(i) some zinc pieces into blue copper sulphate solution?

(ii) some copper pieces into green ferrous sulphate solution?

(c) Name a metal which combines with hydrogen gas. Name the compound formed. **[2005]**

14. (i) Define the terms 'alloy' and 'amalgam'. Name the alloy used for welding electric wires together. What are its constituents?

(ii) Name the constituents of the following alloys

(a) Brass (b) Stainless steel (c) Bronze

State one property of each of these alloys, which is different from its main constituent. **[2005]**

15. What is meant by the term 'enrichment of ore'? Name four methods generally used for enrichment of ores. With the help of a labelled diagram, describe the method for the enrichment of sulphide ores. **[2005]**

ASSIGNMENTS FOR FORMATIVE ASSESSMENT

A. Experiments

(To be demonstrated by the teacher or performed by the students)

1. Objective

To study the reaction of metals with water under different temperature conditions and arrange them in the decreasing order of reactivity.

Materials Required

Following pure metals in form of very small chips and weighing about 1 g.

(i) calcium (ii) magnesium (iii) aluminium (iv) copper (v) zinc (iii) iron and (vii) lead

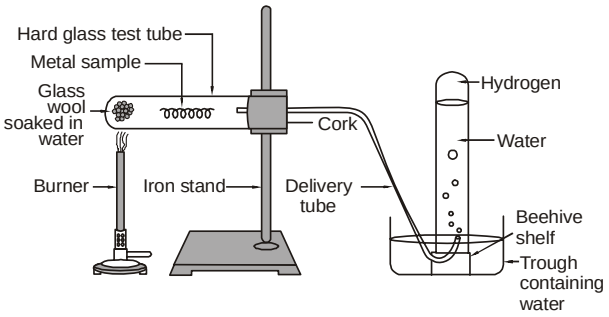
A rack of test tubes, beakers, a hard glass boiling tube, a rubber cork fitted with a delivery tube, a gas

cylinder, a trough of water, iron stand, bunsen burner, glass wool and a stop watch.

Note : *Sodium and potassium metals are not choosen as they react explosively with water and can cause accidents.*

Procedure

1. Take seven test tubes and place 1 g of the sample of metals provided in each of them .
2. Half fill the test tubes with cold water and observe, if any of the metals reacts with cold water to produce tiny bubbles of colourless gas (hydrogen gas).
3. Note the name of the metal in the observation chart and the condition under which it reacts with water.
4. Now take out the metal pieces from the test tubes that do not react. Boil about 50 ml of water in a beaker. Pour the boiling water in these test tubes and then drop the remaining metals one by one in each test tube.
5. Observe, which metal gives tiny bubbles of colourless gas with hot water. Record your observations in the observation chart.
6. Remove the metals that do not react with boiling hot water from the test tubes and perform the following experiment with each of them separately.



(a) Introduce the glass wool soaked in water in the hard glass boiling tube and then the sample of the given metal.

(b) Set up the apparatus as shown in the figure and heat the glass wool on a strong bunsen flame.

(c) When the bubbles of gas start coming out, start the stop watch. Allow the gas to collect for two minutes and find the approximate volume of the gas collected, by measuring the drop in the level of water.

(d) Record your observation for the concerned metal in the observation table.

7. Repeat the same experiment for other metals and record your observations in the observation table.

S.No.	*Metals*	*Reaction Condition*			
		Cold water	*Hot water*	*Steam*	**Rate of reaction*
1.	Calcium				
2.	Magnesium				
3.	Aluminium				
4.	Copper				
5.	Zinc				
6.	Iron				
7.	Lead				

* In rate of reaction, state fastest, slower than calcium, slower than magnesium, etc.

Science Quiz

1. On the basis of the above experiment arrange the metals in the decreasing order of reactivity. Discuss why the reactivity of metals decreases.
2. What is the type of reaction takes place between the metals and water?
3. Write fully balanced equations for the reactions of metals with water along with the experimental conditions.
4. Why does copper metal not react with water under any conditions?
5. Does oxidation or reduction of metals take place?

6. Does oxidation or reduction of water take place?

2. Objective

To study the reaction of metals with dilute hydrochloric acid and arrange them in the decreasing order of reactivity.

Materials required

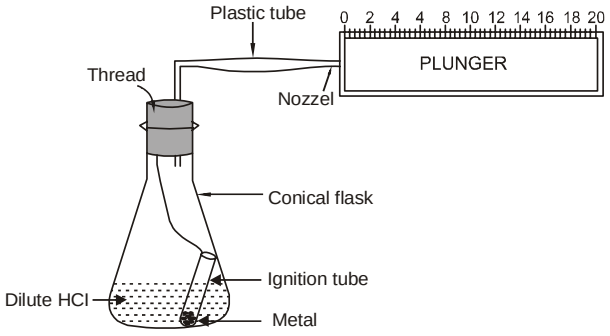
One g of each of the following metals in the form of small chips:

(i) magnesium (ii) aluminium (iii) zinc (iv) iron (v) lead (vi) tin and (vii) copper

A conical flask, a small ignition tube, a cork with one hole fitted with a small glass tubing bent at right angles, a plastic tube, a 20 cc syringe, 50 ml measuring cylinder and a stop watch.

Procedure

1. Tie a long cotton thread to the ignition tube and place 1 g of the given metal sample in it.
2. Lower the tube in the conical flask, containing 20 ml of hydrochloric acid and allow it to rest along the side of the conical flask.
3. Fix the cork with glass tubing in the mouth of the conical flask.
4. To the other end of the glass tubing attach a plastic tube. Connect the other end of the plastic tube to the nozzle of a 20 cc syringe, whose plunger is at zero mark.
5. Slightly lift the cork and allow the ignition tube to fall in the hydrochloric acid by gentle shaking.
6. Immediately replace the cork and start the stop watch.
7. The metal will react with hydrochloric acid to form metal chloride and hydrogen. Collect the gas for 2 minutes and record its volume in the observation table.
8. Repeat the experiment for other samples and collect the gas for 2 minutes. Record the volume of the gas collected in each case in the observation table.



OBSERVATION TABLE

S.No.	*Metals*	*Volume of gas*
1.	Magnesium	
2.	Aluminium	
3.	Zinc	
4.	Iron	
5.	Lead	
6.	Tin	
7.	Copper	

Precautions

1. Wash the conical flask, ignition tube after each experiment.
2. The plunger of syringe should be in zero position, before the start of the experiment.
3. The apparatus should be airtight.

Science Quiz

1. From the above observations arrange the metals in the order of decreasing chemical activity.
2. Why did copper not react with dilute hydrochloric acid?
3. Why the reaction of hydrochloric acid with tin is very very slow?
4. Why do we use tinned copper vessels or brass vessels for cooking?
5. What kind of reaction takes place between the metals and dilute hydrochloric acid?
6. Write fully balanced equations for the reaction of metals mentioned above with (i) hydrochloric acid (ii) sulphuric acid.

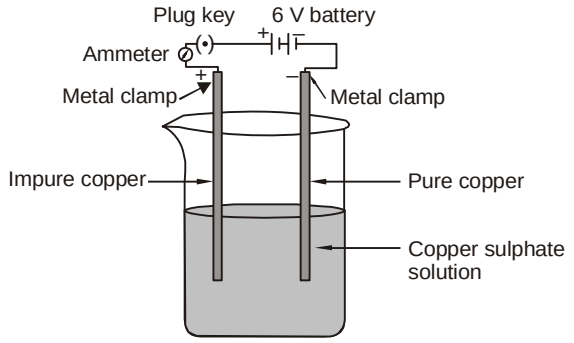
3. Objective

To purify impure copper by electrolysis

Materials Required

Impure thick copper strip, a thin pure copper strip, connecting wires, plug key, an ammeter (0-5A), 6V battery, copper sulphate crystals (3g), distilled water, measuring cylinder (0-100 ml), beaker (250ml), dilute sulphuric acid, glass rod and two metal clamps.

Procedure



1. Measure 100 ml of distilled water with the help of a measuring cylinder.
2. Transfer the distilled water in a 250 ml beaker. This beaker will serve as an electrolytic cell.
3. Take 3 g of copper sulphate crystals and dissolve them in 100 ml of distilled water in the beaker above, with the help of a glass stirrer.
4. Add 2 ml of dil. sulphuric acid to the copper sulphate solution.
5. Connect the 6V battery, through a plug key and an ammeter to the two metal clips/clamps as shown in the diagram.
6. Connect the impure copper strip to the positive terminal of the battery and the impure copper strip to the negative terminal by the metal clips.
7. Gently lower the pure copper and impure copper strips in copper sulphate solution, taking care they do not touch each other or are too close to one another.
8. Note the colour of copper sulphate solution and the approximate thickness of the metal plates.
9. Switch on the current. The ammeter will show the magnitude of current. Cover the beaker with a cardboard and allow the current to pass for one hour.
10. At the end of one hour make observations regarding the colour of copper sulphate solution, thickness of impure copper plate, the thickness of pure copper plate and the colour of freshly deposited copper.

Observations

Initial colour of copper sulphate solution : .....

Final colour of copper sulphate solution : .....

Any change in the colour of copper sulphate solution : .....

Change in thickness of impure copper : .....

Change in thickness of pure copper : .....

Colour of freshly deposited copper : .....

Precautions

1. Copper sulphate solution is poisonous in nature. Handle it carefully.
2. The thin strip of copper should be of pure copper.
3. The pure copper strip should always be connected to the negative terminal.
4. The copper strips should not touch each other or be too close to each other.

Science Quiz

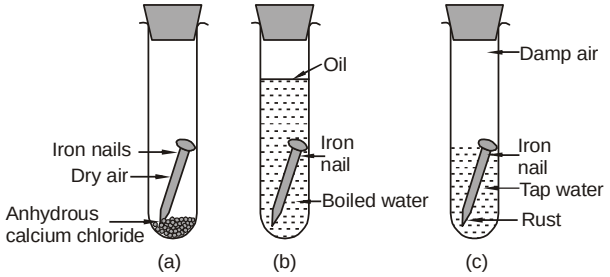
1. Why is dilute sulphuric acid added to copper sulphate solution, which by itself is a strong electrolyte?
2. Why is the impure copper plate connected to the positive terminal of the battery (anode)? Why is the pure copper plate connected to the negative terminal of the battery (cathode)?
3. State ionic reactions taking place at the cathode.
4. State ionic reactions taking place at the anode.
5. What happens to SO_4^{2-} ions in the solution?
6. Where does the reduction of copper ions take place?
7. Where does the oxidation of copper atoms take place?
8. What happens to the impurities present in impure copper ?
9. Will the copper deposit on tin or lead, if it is used as cathode?
10. Why does the colour of copper sulphate not change?
11. What is the role of electricity in the above process?

4. Objective

To study the conditions necessary for rusting of iron

Materials Required

Three bright iron nails, three test tubes, preboiled distilled water, tap water, three rubber corks, anhydrous calcium chloride, a candle.



Procedure

1. Take three test tubes and label them A, B and C.
2. In test tube A place about 2 g of anhydrous calcium chloride and then an iron nail. Cork the test tube and seal it with molten wax from a lighted candle. Anhydrous calcium chloride is purposely placed in the test tube, so as to absorb moisture present in air and hence make the air absolutely moisture free.
3. Distilled water is preboiled so as to expel out any dissolved air in it. Fill 2/3 of test tube B with preboiled distilled water and then drop an iron nail in it. Pour about 1 ml of kerosene oil or mustard oil over the distilled water, so as not to allow any air redissolve in water. Cork the test tube and seal it with molten wax from a lighted candle.
4. In test tube C place an iron nail and then pour tap water such that 1/3 of the tube is filled with it. Cork the test tube and seal it with sealing wax.
5. Place the test tubes in a test tube stand and leave them undisturbed for one week.
6. Check the test tubes after one week and find out in which test tube iron rusts.

Group Discussions

1. Discuss why the iron nail did not rust in test tube A. Can dry air cause rusting?
2. Discuss why the iron nail did not rust in test tube B. Can pure water alone cause rusting?
3. Discuss why the iron nail rusts in test tube C. What are the conditions for rusting?
4. Discuss why the hulls of ships made from steel rust in sea water. How can it be prevented?
5. Discuss, why are the rims of bicycle, nickel or chrome plated.
6. Discuss, why are bridges made of steel coated with a paint of red lead oxide.
7. Discuss, why are steel sheets used for roofing galvanished.
8. Discuss, why are the bodies of automobiles painted with synthetic paints.

B. Charts

1. Make a multicoloured chart for the metal reactivity series in descending order, with reference to the action of metals with (i) oxygen, (ii) water, (iii) hydrochloric acid.
2. Make a chart for obtaining pure metal from its ore by different processes showing the various steps involved for different kind of metals
3. Make a chart for concentration of sulphide ores by froth floatation process.
4. Make a pictorial chart for the uses of the following alloys :

   (i) stainless steel (ii) brass (iii) bronze (iv) solder

   Also state the metals used for making the above alloys.

C. Visits

1. Visit a goldsmith and a silversmith and find out how they make alloys of metals and how they make ornaments. Make a report and submit it to your teacher.

Question 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.

Answer

(i) Metal that exists in liquid state at room temperature → Mercury

(ii) Metal that can be easily cut with a knife → Sodium

(iii) Metal that is the best conductor of heat → Silver

(iv) Metals that are poor conductors of heat → Mercury and lead

Question 2:

Explain the meanings of malleable and ductile.

Answer

Malleable: Substances that can be beaten into thin sheets are called malleable. For example, most of the metals are malleable.

Ductile: Substances that can be drawn into thin wires are called ductile. For example, most of the metals are ductile.

Question 1:

Define the following terms.

(i) Mineral (ii) Ore (iii) Gangue

Answer

(i) Mineral: Most of the elements occur in nature as in combined state as minerals. The chemical composition of minerals is fixed.

(ii) Ore: Minerals from which metals can be extracted profitably are known as ores.

(iii) Gangue: The impurities (sand, silt, soil, gravel, etc.) present in the ore are called gangue.

Question 2:

Write equations for the reactions of

(i) iron with steam

(ii) calcium and potassium with water

Answer

(i) $3Fe_{(s)} + 4H_2O_{(g)} \longrightarrow Fe_3O_{4(aq)} + 4H_{2(g)}$

Iron Steam Iron (II,III) oxide Hydrogen

(ii) $Ca_{(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)} + H_{2(g)} + Heat$

$2K_{(s)} + 2H_2O_{(l)} \longrightarrow 2KOH_{(aq)} + H_{2(g)} + Heat$

Calcium/ Potassium Water Calcium Hydroxide/ Potassium hydroxide Hydrogen

Question 3:

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	Cooper (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.

(i) Which is the most reactive metal?

(ii) What would you observe if B is added to a solution of copper (II) sulphate?

(iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.

Answer

Explanation

A + $FeSO_4$ → No reaction, i.e., A is less reactive than iron

A + $CuSO_4$ → Displacement, i.e., A is more reactive than copper

B + $FeSO_4$ → Displacement, i.e., B is more reactive than iron

B + $ZnSO_4$ → No reaction, i.e., B is less reactive than zinc

C + $FeSO_4$ → No reaction, i.e., C is less reactive than iron

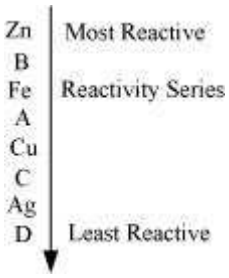
C + $CuSO_4$ → No reaction, i.e., C is less reactive than copper

C + $ZnSO_4$ → No reaction, i.e., C is less reactive than zinc

C + $AgNO_3$ → Displacement, i.e., C is more reactive than silver

D + $FeSO_4$/$CuSO_4$/$ZnSO_4$/$AgNO_3$ → No reaction, i.e., D is less reactive than iron, copper, zinc, and silver

From the above equations, we obtain:



(i) B is the most reactive metal.

(ii) If B is added to a solution of copper (II) sulphate, then it would displace copper.

B + $CuSO_4$ → Displacement

(iii) The arrangement of the metals in the order of decreasing reactivity is:

B > A > C > D

Question 4:

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.

Answer

Hydrogen gas is evolved when dilute hydrochloric acid is added to a reactive metal.

When iron reacts with dilute H_2SO_4, iron (II) sulphate with the evolution of hydrogen gas is formed.

$$Fe_{(s)} + H_2SO_{4(aq)} \longrightarrow FeSO_{4(aq)} + H_{2(g)}$$

Question 5:

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

Answer

Zinc is more reactive than iron. Therefore, if zinc is added to a solution of iron (II) sulphate, then it would displace iron from the solution.

$$Zn_{(s)} + FeSO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + Fe_{(s)}$$

Question 1:

(i) Write the electron-dot structures for sodium, oxygen and magnesium.

(ii) Show the formation of Na_2O and MgO by the transfer of electrons.

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

Answer

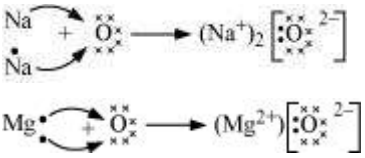
(i) The representation of elements with valence electrons as dots around the elements is referred to as electron-dot structure for elements.

(a) Sodium (2, 8, 1) = Na

(b) Oxygen (2, 6) = O

(c) Magnesium (2, 8, 2) = Mg

(ii)



(iii) The ions present in Na_2O are Na^+ and O^{2-} ions and in MgO are Mg^{2+} and O^{2-} ions.

Question 2:

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

Answer

The metals at the bottom of the reactivity series are mostly found in free state. For example: gold, silver, and platinum.

Question 3:

What chemical process is used for obtaining a metal from its oxide?

Answer

The chemical process used for obtaining a metal from its oxide is reduction. In this process, metal oxides are reduced by using suitable reducing agents such as carbon or by highly reactive metals to displace the metals from their oxides.

For example, zinc oxide is reduced to metallic zinc by heating with carbon.

$$ZnO_{(s)} + C_{(s)} \xrightarrow{\Delta} Zn_{(s)} + CO_{(g)}$$

Manganese dioxide is reduced to manganese by treating it with aluminium powder. In this case, aluminium displaces manganese from its oxide.

$$3MnO_{2(s)} + 4Al_{(s)} \longrightarrow 3Mn_{(l)} + 2Al_2O_{3(s)} + Heat$$

Oxides of more reactive metals are reduced by electrolysis.

Question 1:

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?

Answer

Metal	Zinc	Magnesium	Copper
Zinc oxide	No reaction	Displacement	No reaction
Magnesium oxide	No reaction	No reaction	No reaction
Copper oxide	Displacement	Displacement	No reaction

Question 2:

Which metals do not corrode easily?

Answer

More reactive a metal is, more likely it is to be corroded. Therefore, less reactive metals are less likely to get corroded. This is why gold plating provides high resistance to corrosion.

Question 3:

What are alloys?

Answer

Alloys are homogeneous mixtures of two or more elements. The elements could be two metals, or a metal and a non-metal. An alloy is formed by first melting the metal and then dissolving the other elements in it. For example, steel is an alloy of iron and carbon.

Question 1:

Which of the following pairs will give displacement reactions?

(a) NaCl solution and copper metal

(b) $MgCl_2$ solution and aluminium metal

(c) $FeSO_4$ solution and silver metal

(d) $AgNO_3$ solution and copper metal.

Answer

(d) $AgNO_3$ solution and copper metal

Question 2:

Which of the following methods is suitable for preventing an iron frying pan from rusting?

(a) Applying grease

(b) Applying paint

(c) Applying a coating of zinc

(d) all of the above.

Answer

(c) Applying a coating of zinc

(We can also apply grease and paint to prevent iron from rusting. However, in case of iron frying pan, grease and paint cannot be applied because when the pan will be heated and washed again and again, the coating of grease and paint would get destroyed.)

Question 3:

An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

(a) calcium

(b) carbon

(c) silicon

(d) iron

Answer

(a) The element is likely to be calcium.

Question 4:

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.

Answer

(c) Food cans are coated with tin and not with zinc because zinc is more reactive than tin.

Question 5:

You are given a hammer, a battery, a bulb, wires and a switch.

(a) How could you use them to distinguish between samples of metals and non-metals?

(b) Assess the usefulness of these tests in distinguishing between metals and non-metals.

Answer

(a) With the hammer, we can beat the sample and if it can be beaten into thin sheets (that is, it is malleable), then it is a metal otherwise a non-metal. Similarly, we can use the battery, bulb, wires, and a switch to set up a circuit with the sample. If the sample conducts electricity, then it is a metal otherwise a non-metal.

(b) The above tests are useful in distinguishing between metals and non-metals as these are based on the physical properties. No chemical reactions are involved in these tests.

Question 6:

What are amphoteric oxides? Give two examples of amphoteric oxides.

Answer

Those oxides that behave as both acidic and basic oxides are called amphoteric oxides.

Examples: aluminium oxide (Al_2O_3), zinc oxide (ZnO)

Question 7:

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

Answer

Metals that are more reactive than hydrogen displace it from dilute acids. For example: sodium and potassium. Metals that are less reactive than hydrogen do not displace it. For example: copper and silver.

Question 8:

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

Answer

In the electrolytic refining of a metal M:

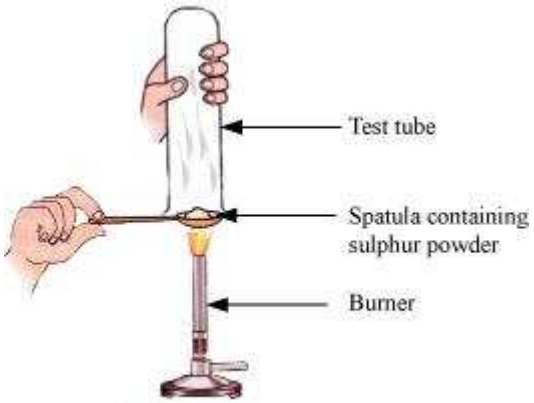
Anode → Impure metal M

Cathode → Thin strip of pure metal M

Electrolyte → Solution of salt of the metal M

Question 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 below.



Collection of gas

(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.

Answer

(a) (i) There will be no action on dry litmus paper.

(ii) Since the gas is sulphur dioxide (SO_2), it turns moist blue litmus paper to red because sulphur dioxide reacts with moisture to form sulphurous acid.

(b)

$$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$$

Sulphur dioxide

$$SO_{2(g)} + H_2O_{(l)} \longrightarrow H_2SO_{3(aq)}$$

Sulphurous acid

Question 10:

State two ways to prevent the rusting of iron.

Answer

Two ways to prevent the rusting of iron are:

(i) Oiling, greasing, or painting: By applying oil, grease, or paint, the surface becomes water proof and the moisture and oxygen present in the air cannot come into direct contact with iron. Hence, rusting is prevented.

(ii) Galvanisation: An iron article is coated with a layer of zinc metal, which prevents the iron to come in contact with oxygen and moisture. Hence, rusting is prevented.

Question 11:

What type of oxides is formed when non-metals combine with oxygen?

Answer

Non-metals combine with oxygen to form acidic oxides.

For example:

$$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$$

(Acidic in nature)

Question 12:

Give reasons

(a) Platinum, gold and silver are used to make jewellery.

(b) Sodium, potassium and lithium are stored under oil.

(c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

Answer

(a) Platinum, gold, and silver are used to make jewellery because they are very lustrous. Also, they are very less reactive and do not corrode easily.

(b) Sodium, potassium, and lithium are very reactive metals and react very vigorously with air as well as water. Therefore, they are kept immersed in kerosene oil in order to prevent their contact with air and moisture.

(c) Though aluminium is a highly reactive metal, it is resistant to corrosion. This is because aluminium reacts with oxygen present in air to form a thin layer of aluminium oxide. This oxide layer is very stable and prevents further reaction of aluminium with oxygen. Also, it is light in weight and a good conductor of heat. Hence, it is used to make cooking utensils.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction because metals can be easily extracted from their oxides rather than from their carbonates and sulphides.

Question 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.

Answer

Copper reacts with moist carbon dioxide in air to form copper carbonate and as a result, copper vessel loses its shiny brown surface forming a green layer of copper carbonate. The citric acid present in the lemon or tamarind neutralises the basis copper carbonate and dissolves the layer. That is why, tarnished copper vessels are cleaned with lemon or tamarind juice to give the surface of the copper vessel its characteristic lustre.

Question 14:

Differentiate between metal and non-metal on the basis of their chemical properties.

Answer

Metal	**Non-metal**

Metals are electropositive.	Non-metals are electronegative.
They react with oxygen to form basic oxides. $4Na + O_2 \longrightarrow 2Na_2O$ These have ionic bonds.	They react with oxygen to form acidic or neutral oxides. $C + O_2 \longrightarrow CO_2$ These have covalent bonds.
They react with water to form oxides and hydroxides. Some metals react with cold water, some with hot water, and some with steam. $2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$	They do not react with water.
They react with dilute acids to form a salt and evolve hydrogen gas. However, Cu, Ag, Au, Pt, Hg do not react. $2Na + 2HCl \longrightarrow 2NaCl + H_2\uparrow$	They do not react with dilute acids. These are not capable of replacing hydrogen.
They react with the salt solution of metals. Depending on their reactivity, displacement reaction can occur. $CuSO_4 + Zn \longrightarrow ZnSO_4 + Cu$	These react with the salt solution of non-metals.
They act as reducing agents (as they can easily lose electrons). $Na \longrightarrow Na^+ + e^-$	These act as oxidising agents (as they can gain electrons). $Cl_2 + 2e^- \longrightarrow 2Cl^-$

Question 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?

Answer

He must have dipped the gold metal in the solution of aqua regia – a 3:1 mixture of conc. HCl and conc. HNO_3. Aqua regia is a fuming, highly corrosive liquid. It dissolves gold in it. After dipping the gold ornaments in aqua regia, the outer layer of gold gets dissolved and the inner shiny layer appears. That is why the weight of gold ornament reduced.

Question 16:

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

Answer

Copper does not react with cold water, hot water, or steam. However, iron reacts with steam. If the hot water tanks are made of steel (an alloy of iron), then iron would react vigorously with the steam formed from hot water.

$$\underset{\text{Iron}}{3Fe} + \underset{\text{Steam}}{4H_2O} \longrightarrow \underset{\text{Iron (II, III) oxide}}{Fe_3O_4} + \underset{\text{Hydrogen}}{4H_2}$$

That is why copper is used to make hot water tanks, and not steel.

Question 1:

Why is sodium kept immersed in kerosene oil?

Answer

Sodium and potassium are very reactive metals and and combine explosively with air as well as water. Hence, they catch fire if kept in open. Therefore, to prevent accidental fires and accidents, sodium is stored immersed in kerosene oil.

Question 2:

Why do ionic compounds have high melting points?

Answer

Ionic compounds have strong electrostatic forces of attraction between the ions. Therefore, it requires a lot of energy to overcome these forces. That is why ionic compounds have high melting points.