Grade X - Science

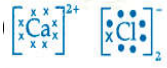
Lesson 3. Metals and Non-Metals

Objective Type Questions

(1 Mark each)

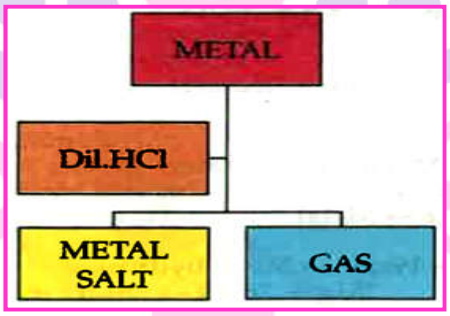
I. Multiple choice questions

1. Which one of the following structures correctly depicts the compound $CaC1_2$?

a. 
b. 
c. 
d. 

Ans. Option (D) is correct.

2.

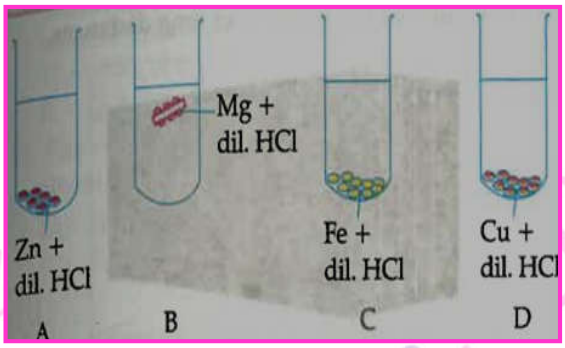


Which of the following two combinations are correct?

	Metal	Gas Evolved	
(i)	Copper	Yes	
(ii)	Iron	Yes	
(iii)	Magnesium	No	
(iv)	Zinc	Yes	

a. (i) and (iii) b. (i) and (iv) c. (ii) and (iii) **d. (ii) and (iv)**

3. The diagram shows the reaction between metal and dil. Acid.



What is the reason for different behaviour of Mg in test tube B?

a. Mg is lighter element than dil. HCl

b. Mg reacts with dil. HCl to produce H_2 gas which helps in floating.

c. mg reacts with dil. HCl to produce N_2 gas which helps in floating.

d. Mg reacts with dil. HCl to produce CO_2 gas which helps in floating.

4. The table shown below gives information about four substances A,B,C and D.

Substance	Melting Point (K)	Electrical Conductivity	
		Solid	Liquid/Aqueous
A	295	Good	Good
B	1210	Poor	Good
C	1890	Poor	Good
D	1160	Poor	Poor

Identify ionic compound from the above given substances.

a. A,B **b. B, C** c. A,B,D d. A,C,D

5. The table given below shows the reactions of a few elements with acids and bases to evolve Hydrogen gas.

Element	Acid	Base
A	X	X
B	√	√
C	√	X
D	√	√

Which of these elements form amphoteric oxides?

a. A and D **b. B and D** c. A and C d. B and D

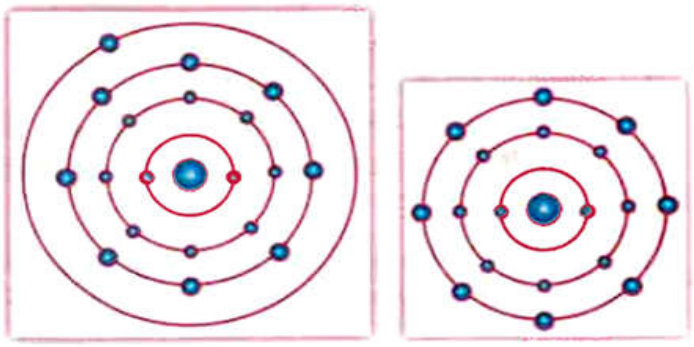
6. A cable manufacturing unit tested few elements on the basis of their physical properties.

Properties	W	X	Y	Z
Malleable	yes	No	No	No
Ductile	Yes	No	No	Yes
Electrical conductivity	Yes	Yes	Yes	No
Melting	High	Low	Low	High

Which of the above elements were discarded for usage by the company?

a. W,X,Y **b. X,Y,Z** c. W,X,Z D.W,X,Z

7. A scientist is attempting to represent an ionic bond between calcium and chlorine. The figure below shows the progress he has made so far.



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

a. Transfer an electron from the calcium atom to the chlorine atom.

b. Transfer an electron from the chlorine atom to the calcium atom.

c. Add another chlorine atom to accept an electron from the calcium atom.

d. Add another calcium atom to donate an electron to the chlorine atom.

8. In which of the following forms do electrovalent compounds conduct electricity?

a. Only in solid form

b. Both in solid form and in aqueous solution

c. Both in aqueous solution and in molten form

d. in solid form, molten form and in aqueous solution

9. Sodium comes after potassium in the reactivity series, so sodium is ……..

a. Not reactive

b. More reactive than potassium

c. Equally reactive as potassium

d. Less reactive than potassium

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

These containers are made of steel. Which property of steel is mainly used to make these containers?

a. Its ductility **b. Its malleability**

b. c. Its metallic Lustre d. Its electrical conductivity

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

$$Zn + \rightarrow Zinc(salt) + H_2 (gas)$$

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

(p) Water

(Q) Hydrochloric acid

(R) A solution of a zinc salt.

a. Only P **b. Only Q** c. Only R d. Either P or R.

12. Given below are reactions involving metals P,Q,R and S and their salt solutions in water.

Metal P salt solution + Q → Metal Q salt solution +P

Metal Q salt solution + R → Metal R salt solution + Q

Metal S salt solution + Q → Metal Q salt solution + Q

Metal P salt solution + S → No reaction

Which metal is the MOST reactive?

a. P b. Q **c. R** d. S

13. The compound obtained on reaction of iron with steam is/are:

a. Fe_2O_3 **b. Fe_3O_4** c. FeO d. Fe_2O_3 and Fe_3O_4

14. An element 'X' reacts with O_2 to give a compound with a high melting point. This compound is also soluble in water. The element 'X' is likely to be:

a. iron **b. calcium** c. carbon d. silicon

15. What happens when calcium is treated with water?

(i) It does not react with water.

(ii) It reacts violently with water.

(iii) It reacts less violently with water.

(iv) Bubbles of hydrogen gas formed stick to the surface of calcium.

a. (i) and (iv) b. (ii) and (iii) c. (i) and (ii) **d. (iii) and (iv)**

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

a. Sulphur b. Oxygen c. Nitrogen **d. Iodine**

17. A 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

18. Which among the following statement 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

19. 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

II. Multiple choice questions

1. 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)

2. 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)**

3. 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

4. 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.

5. 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)

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

a. Gallium b. Aluminium **c. Zinc** d. silver

7. 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

III. Multiple choice questions

1. lighter liquid metal is

a. Hg b. Ga **c. Cs** d. Fr

2. Which of the statement about the reaction, $ZnO + CO \rightarrow Zn + CO_2$

a. ZnO is being oxidised b. CO is being reduced

c. CO_2 is being oxidised **d. ZnO is being reduced**

3. The most abundant element in the universe is

a. Hydrogen b. Helium c. Carbon d. Oxygen

4. In extraction of copper, the flux used is

a. CaO **b. SiO_2** c. FeO d. $FeSiO_3$

5. Cu_2S 3 $Cu_2O \rightarrow 6\ Cu + SO_2$

The above process is

a. auto-reduction b. chemical reduction

c. electrolytic reduction d. None of these

6. Which of the following represent mercury (I) ion correctly?

a. Hg^{+} b. Hg^{2+} **c. Hg_2^{2+}** d. Hg

7. Bauxite is mixed with cryolite so as to

(i) reduce its melting point

(ii) increase its electrical conductivity

(iii) molten cryolite acts as solvent

(iv) increase its melting point

a. **(i), (ii) and (iii)** b. (ii), (iii) and (iv)

c. (iii) and (iv) d. (i) and (ii)

8. Which of the following is purest form of carbon?

a. Diamond b. Graphite c. Fullerene d. Charcoal

9. An element 'X' is yellow coloured solid, insoluble in water but soluble in carbon disulphide. It has low melting point 114.5^{0}C. It boils at 445^{0}C and it burns with pale blue flame forming pungent smelling gas 'Y' which turns moist blue litmus red and finally colourless. 'X' and 'Y' are.

a. C, CO_2 b. N, NO_2 **c. S, SO_2** d. I_2, I_2O_5

10. In electrolytic refining of copper, the electrolyte used is

a. CuO b. $Cu(OH)_2$

c. Acidified $CuSO_4$(aq) d. $CuSO_4$(s)

11. Which of the following ore is concentrated by froth floatation process?

a. $ZnCO_3$ b. ZnO **c. ZnS** d. Na_2S

12. Which of the following metals liberate hydrogen with 5% HNO_3?

(i) Cu (ii) Zn (iii) Mn (iv) Mg

a. (i) and (ii) b. (ii) and (iii) **c. (iii) and (iv)** d. (i) and (iv)

13. Which one of the following metals do not react with cold as well as hot water?

a. Na b. Ca c. Mg **d. Fe**

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

a. FeO b. Fe_2O_3 **c. Fe_3O_4** d. Fe_2O_3 and Fe_3O_4

15. 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. H_2SO_4 b. HCl **c. HNO_3** d. All of these

16. 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**

17. 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)**

18. 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

19. 2 ml each of concentrated HCl, HNO_3 and a mixture of concentrated HCl and concentrated HNO_3 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. Ag

20. An electrolytic cell consists of

(i) positively charged cathode (ii) negatively charged anode

(iii) Positively charged anode (iv) negatively charged cathode

a. (i) and (ii) **b. (iii) and (iv)** c. (i) and (iii) d. (ii) and (iv)

21. 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

22. Alloys are homogeneous mixtures of metal with a metal or non-metal as one of its constituents?

a. Brass b. Bronze c. Amalgam **d. Steel**

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

a. Stainless steel b. Alnico c. Solder **d. Zinc amalgam**

24. Reaction between X and Y, forms compounds 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

25. 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**

26. Although metals form basic oxides, which of the following metals form an amphoteric oxide?

a. Na b. Ca **c. Al** d. Cu

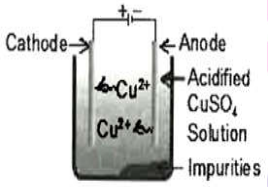
27. Which of the following can undergo a chemical reaction?

a. $MgSO_4$ + Fe b. $ZnSO_4$ + Fe

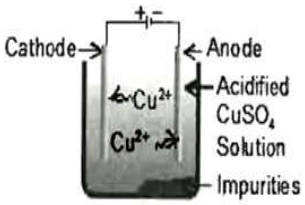
c. $MgSO_4$ + Pb **d. $CuSO_4$ + Fe**

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

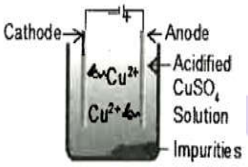
a.



b.



c.



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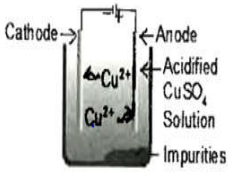


Ans. Option (c) correct.

I Assertion & Reason

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

(A)Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is Not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is true.

1. **Assertion** : Al_2O_3 is an amphoteric oxide.

Reason : Al_2O_3 reacts with acid as well as base to form salt and water.

Ans. Option (A) is correct.

2. **Assertion** : Nitrogen is non-metal.

Reason : Nitrogen has 5 valence electrons.

Ans. Option (B) is correct.

3. **Assertion** : Copper does not reacts with the H_2SO_4.

Reason : Copper is more reactive than hydrogen.

Ans. Option (C) is correct.

4. **Assertion** : Highly reactive metals are obtained by electrolytic reduction of their Molten ore.

Reason : Highly reactive metals can be extracted by chemical reduction.

Ans. Option (C) is correct.

5. **Assertion** : Silver becomes black in colour when exposed to atmosphere.

Reason : Silver reacts with H_2S gas to form Ag_2S Which is black in colour.

Ans. Option (A) is correct.

II Assertion & Reason

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

(A)Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is Not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is true.

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

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

Ans. Option (B) is correct.

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

Reason (R) : Reduction of oxides occurs easier.

Ans. Option (A) is correct.

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

$Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

Reason (R) : In this reaction, cu_2S is the reducing agent whereas Cu_2O is the Oxidising agent.

Ans. Option (A) is correct.

4. **Assertion** : In alumina thermite process, the metals like iron melts due to the heat evolved in the reaction.

Reason :The reaction is:

$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

Ans. Option (A) is correct.

III Assertion & Reason

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

(A)Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is Not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is true.

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

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

Ans. Option (A) is correct.

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

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

Ans. Option (C) is correct.

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

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

Ans. Option (A) is correct.

4. **Assertion (A)** : Aluminium when heated in air form aluminium oxide, which show both acidic and basic behaviour.

Reason (R) : Aluminium when heated in air form aluminium oxide, which show Both acidic and basic behaviour.

Ans. Option (A) is correct.

5. **Assertion (A)** : The displacement reaction depends on reactivity series.

Reason (R) : A metal can displace a salt if the metal is higher in reactivity series.

Ans. Option (A) is correct.

Fill in the blanks

1. Cinnabar is an ore of _____.

   Ans. mercury

2. The most abundant metal in earth crust is _____.

   Ans. Aluminium

3. The formula of calcium nitride is _____.

   Ans. Ca_3N_2

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

   Ans. $CuCO_3$

5. During electrolytic refining of zinc, it gets deposited on_____.

   Ans. cathode.

6. Only one metals, _____ is in liquid state at the room temperature.

   Ans. mercury.

7. _____ and _____ can be easily cut with knife.

   Ans. sodium, potassium.

8. Metal reacts with water to give _____ and hydrogen gas.

   Ans. metal hydroxide.

9. _____ is a non-metal which is Lustrous.

   Ans. iodine

10. _____ is a non-metal which has a very high melting and boiling point.

    Ans. Diamond.

11. The corrosion of iron is called _____.

    Ans. rusting.

True or False

1. When a strip of copper metal is placed in iron(II) sulphate solution, then red-brown copper metal if formed.

   Ans. False

2. When zinc is added to a solution of iron (II) sulphate, then the greenish colour of iron sulphate solution fads gradually due to the formation of colourless zinc sulphate solution and iron is deposited on zinc.

   Ans. True

3. A negatively charged ion is known as cation.

   Ans. False.

4. The electronic configuration of a sodium ion is the same as that of the nearest inert gas helium.

   Ans. False.

5. Haematite is an ore of copper.

   Ans. False.

6. The widely used method for refining impure metal is electrolytic refining.

   Ans. True.

Match the following

Column I	Column II
(i) Sodium	(A) forms black oxide
(ii) Copper	(B) forms black metal sulphide
(iii) Silver	(C) occurs in free state
(iv) Gold	(D) reacts explosively with cold water
(v) Zinc	(E) used in galvanisation

Ans. (i) (D), (ii) (A), (iii) (B), (iv) (C), (v) (E)

Very short Answer Type questions

(1 mark)

1. **Identify the product formed when 1 ml of dil. Hydrochloric acid is added to 1g of sodium metal?**

   Ans. Sodium chloride and Hydrogen gas

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

   Ans. X is carbon, Y is diamond as it is the hardest natural substance and Z is graphite as it is good conductor of electricity.

3. **Choose the amphoteric oxides amongst the following: Na_2O, Al_2O_3, CO_2,H_2O, ZnO**

   Ans. ZnO and Al_2O_3

4. **How are oxides of metal different from oxides of non metals in terms of their nature?**

   Ans. Metallic oxides are basic, few are amphoteric.

   Non-metallic oxides are acidic, few are neutral.

5. **Why the wires carrying current in homes have a coating of PVC?**

   Ans. The wires carrying current in home have a coating of PVC. This is because PVC is an insulting substance and protects from electric shock.

6. **In nature, Aluminium is found in combine state whereas silver, gold is found in free state. Give reason.**

   Ans. Aluminium is reactive metal while silver and gold are non reactive metal.

7. **Why carbon is not considered as a good reducing agent while reducing alumina?**

   Ans. Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina (Al_2O_3) to aluminium.

8. **Show by equation, the product formed when zinc carbonate is heated in absence of oxygen.**

   Ans. ZnO(s) and CO_2 (g) are formed.

   $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

9. **Why are the heating elements of electric toasters and electric irons made of an alloy rather than a pure metal?**

   Ans. Due to high resistivity of alloys rather than its constituting metals.

10. What are metal?

Ans. Those elements which can lose electrons easily and form positive ions. They are mostly solids, possess high density.

11. Name the metal which reacts with a very dilute HNO_3 to evolve hydrogen gas.

Ans. Magnesium.

12. What is electrical conductance?

Ans. It is property due to which electric current can pass through the metal. It is due to presence of free electrons or mobile electrons, e.g copper, silver, gold, aluminium are good conductors of electricity.

13. What do you mean by Thermal conductivity?

Ans. It is the property due to which metals can conduct heat e.g. copper, silver, gold, aluminium and iron are good conductors of heat.

14. What is metallic Lustre?

Ans. Most of metals have shiny surface i.e, they show metallic Lustre e.g. Au,Ag, Pt are Lustrous.

15. Name any one metal which reacts neither with cold water nor with hot water, but reacts with heated steam to produce hydrogen gas.

Ans. Iron; $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

16. Arrange the following metals in the decreasing order of reactivity:

Na,K,Cu,Ag

Ans. K > Na >Cu >Ag

17. Metals generally occur in solid state. Name and write symbol of a metal that exist in liquid state at room temperature.

Ans. Mercury(Hg) exists in liquid state at room temperature.

18. Name two metals that are soft and can be cut with knife.

Ans. Na(Sodium) and K (Potassium)

19. Which of the following two metals will melt at body temperature (37^0C)?

Gallium, Magnesium, Cesium, Aluminium

Ans. Gallium, Cesium

20. Name the property due to which metal produces sound?

Ans. Sonorous.

21. Why are metals Lustrous?

Ans. They absorb light and radiate a part of it.

22. Reaction of metal with dilute acid is exothermic or endothermic process?

Ans. Exothermic process.

24. Which metal does not react with water at all?

Ans. Copper because it is less reactive than hydrogen.

25. Why do we use copper and aluminium wire for transmission of electric current?

Ans. It is because copper and Al are good conductor of electricity and ductile, i.e. drawn into wires easily.

26. Which gas is liberated when a metal reacts with an acids? How will you test the presence of this gas?

Ans. Hydrogen gas is formed. Being a burning matchstick near to it, H_2 will burn with pop sound.

27. When metal reacts with nitric acid, H_2 is not evolved why?

Ans. HNO_3 is good oxidising agent, therefore, it oxidise H_2 to H_2O and itself gets reduced to N_2O, NO and NO_2 depending upon concentration of acids.

28. Why does calcium float in water?

Ans. It is because hydrogen gas is formed which sticks to surface of calcium, therefore it floats.

29. From amongst the metals sodium, calcium, aluminium, copper and magnesium, name the metal

(a) Which reacts with water only on boiling, and

(b) another which does not react even with steam.

Ans. (a) Magnesium reacts with water only on boiling.

(b) Copper does not react even with steam.

30. What are non-metals?

Ans. Those elements which can gain electrons easily.

31. In which physical state non-metals are found?

Ans. Solid, liquid, gas.

32. Why are non-metals brittle?

Ans. It is due to weak forces of attraction.

33. Name a non-metal which is Lustrous and a metal which is non-Lustrous.

Ans. Iodine is a non-metal which is Lustrous, lead is non-Lustrous metal.

34. Why are electrical wires covered with PVC?

Ans. PVC acts insulator, therefore, electric wires are coated with plastic so that we do not get electric shock on touching wires.

35. Give most suitable word for the following statements:

(a) Metal oxides which show acidic as well as basic behaviour.

(b) Iodine, a shining non-metal.

Ans. (a) Amphoteric

(b) Lustrous

36. Name one metal and one non-metal in liquid state at room temperature.

Ans. Mercury is a liquid metal and bromine is liquid non-metal.

37.Name the ion made by non-meta; Cations/anion.

Ans. Anions (negative ions) because non-metals can gain electrons easily.

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

Ans. 'A' is non-metal as non-metallic oxides are acidic in nature.

39. Copper does not react with dil. HCl and dil. H_2SO_4 why?

Ans. Because it is less reactive than hydrogen.

40. What are basic oxides?

Ans. Those oxide, which react with acids or acidic oxides to form salt and water are called basic oxides.

41. What are acidic oxides.

Ans. Those oxides, which react with bases or basic oxides to form salt and water, are called acidic oxides. e.g., CO_2 (carbon dioxide), SO_2 (sulphur dioxide), SO_3 (sulphur trioxide), P_2O_5 (Phosphorus pentoxide), SiO_2 (silicon dioxide) are acidic oxides.

42. Can we store $CuSO_4$ in Mg container?

Ans. No. Mg is more reactive than Cu, it will displace copper from copper sulphate.

43. How does Cl change to Cl^- ?

Ans. By gain of one electron.

44. What happens when Zn reacts with NaOH?

Ans. H_2 gas is liberated and sodium zincate is formed.

45. Write the chemical equation for the reaction taking place when steam is passed over hot aluminium.

Ans. $2Al(s) + 3H_2O(g) \rightarrow Al_2O_3(s) + 3H_2(g)$

46. What is name given to electrons lost or gained by an element?

Ans. Electrovalency

47. What happens when carbon dioxide is compressed in water at higher pressure?

Ans. Carbonic acid is formed.

$CO_2 + H_2O \rightarrow H_2CO_3$

48. Choose the amphoteric oxide amongst the following:

Na_2O, ZnO, Al_2O_3, CO_2, H_2CO_3.

Ans. Al_2O_3 and ZnO are amphoteric oxides, Na_2O is basic, H_2O is neutral, CO_2 is acidic oxide.

49. Define native state.

Ans. Some metal exist in free state or uncombined state. The free state or uncombined state is also called 'native state) state in nature. Gold, silver, copper, platinum and bismuth are found in the free state due to their low reactivity.

50. What is metallurgy?

Ans. All the process involved in the extraction of metals from their ores and refining them for use, is called metallurgy.

51. What is ore-dressing?

Ans. It is a process of removing unwanted substances from the ore. This is also known as concentration of the ore of enrichment of ore. It is usually done by hydraulic, washing, magnetic separation or froth floatation process.

52. How are sulphide ores concentrated?

Ans. By hydraulic washing.

53. How is copper refined?

Ans. By electrolytic refining.

54. Why sulphide and carbonate ores are converted into oxide?

Ans. It is because it is easier to reduce oxides as compared to sulphide and carbonate ores.

55. Why oxide of highly reactive metals can not be reduced by carbon?

Ans. It is because highly reactive metals themselves are stronger reducing agents than carbon.

56. What is formulae of rust?

Ans. $Fe_2O_3.\ xH_2O$ is formula of rust.

57. A green layer is gradually formed on a copper plate left exposed to air for week in a bathroom. What could this green substance be?

Ans. It is due to the formation of basic copper carbonate $[CuCO_3.Cu(OH)_2]$

58. Define amalgam.

Ans. When a metal is alloyed with mercury, it is called amalgam.

59. Why do we prefer steel over iron?

Ans. It does not get rusted.

60. Which metal is present both is solder and bronze?

Ans. Tin

61. Which metal is present both in brass and bronze?

Ans. Copper

62. Why is solder used for welding electrical wires?

Ans. It has low melting point.

63. What is anodising?

Ans. The process of forming oxide layer on the surface of metal is called anodising, e.g., Aluminium forms an oxide layer on its surface when exposed to air. It is non-penetrating layer which protects it from corrosion. The layer can be made more thick with the help of anodising.

64. What is the process of depositing zinc on iron called?

Ans. It is called galvanisation.

65. Which one of the methods given in Column I are used for extraction of each of the metals given in Column II.

Column I	Column II
(i) Electrolytic reduction	Al
	Zn
(ii) Reduction with carbon	Na
	Fe
(iii) Reduction with Al	Mn
	Sn

Ans. (i) Electrolytic reduction is used in case of Al, Na.

(i) Reduction with carbon is done in case of Zn, Fe, Sn.

(ii) Reduction with Al is carried out in case of Mn.

66. In nature, Aluminium is found in combine state whereas silver, gold is in free state. Give reason.

Ans. Aluminium is reactive metal while silver and gold are non reactive metals.

67. Why carbon is not considered as a good reducing agent while reducing alumina?

Ans. Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina (Al_2O_3) to aluminium.

68. Show by equation, the product formed when zinc carbonate is heated in absence of oxygen.

Ans. $ZnO(s) \xrightarrow{\Delta} ZnO + CO_2$

69. Why are the heating elements of electric toasters and electric irons made of an rather than a pure metal?

Ans. Due to high resistivity of alloys rather than its constituting metals.

Detailed Answer:

Because the resistivity of an alloy is higher than a pure metal. Also, alloys do not melt easily at high temperatures.

[3 Marks]

Short Answer Type Questions - I

1. State three reasons for the following facts:

(a) Sulphur is a non-metal

(b) Magnesium is a metal

One of the reasons must be supported with a chemical equation.

Ans.

(a) Sulphur is a non - metal	**(b)Magnesium is a metal**
(i) Poor conductor of heat and electricity. (ii) Neither malleable nor ductile. (iii) $S + O_2 \rightarrow SO_2$ Sulphur dioxide is acidic oxide. $SO_2+H_2O \rightarrow H_2SO_3$ (Sulphurous acid)	(i) Good conductor heat and electricity. (ii) Malleable and ductile (iii) $2Mg + O_2 \rightarrow 2MgO$ Magnesium oxide is basic in nature. $MgO + H_2O \rightarrow Mg(OH)_2$ (Magnesium hydroxide)

2. Write one example of each of the following:

(a) A Metal and non-metal which are liquids at room temperature.

(b) A metal which is very soft and a non metal which is very hard.

(c) A metal which has very low melting point and a non metal which has very high melting point?

Ans. (a) Mercury is metal, bromine is non-metal, liquid at room temperature.

(b) Sodium is very soft metal, diamond is very hard non-metal.

(c) Gallium has low melting point, diamond is very hard non- metal.

3. Explain the following:

(a). Sodium chloride is an ionic compound which does not conduct electricity in solid state where as it does conduct electricity in molten in solid state as well as in aqueous solution.

(b) Reactivity of aluminium decrease if it is dipped in nitric acid.

(c) Metals like calcium and magnesium are never found in their free state in nature.

Ans. (a) Sodium chloride is ionic compound because it is made up of Na^+ and Cl^- ions.

It does not conduct electricity in solid state because ions are not free to move.

It conducts electricity in molten state because ions are free to move.

(b) It is due to formation of oxide layer on its surface which makes it passive(less reactive) HNO_3 is good oxidising agent.

(c) It is because Mg and Ca are highly reactive, react with other elements to form compounds, therefore, are not found in free state.

4. Write one example of each of the following:

(a) Most malleable metal and most ductile metal.

(b) The best conductor of heat and the poorest conductor of heat.

(c) A metal with highest melting point and a metal with lowest melting point.

Ans. (a) Gold is the most malleable and ductile metal.

(b) Silver is the best conductor, whereas lead is poor conductor of heat.

(c) Tungsten as highest melting point, Mercury has the lowest melting point.

5. Write balanced equations for the reactions of :

(a) aluminium when heated in air. Write the name of the product.

(b) iron with steam. Name the product obtained.

(c) calcium with steam. Why does calcium start floating in water?

Ans. (a) $4Al + 3O_2 \xrightarrow{heat} 2Al_2O_3$.

The product formed is aluminium oxide.

(b) $3Fe + 4H_2O(steam) \rightarrow Fe_3O_4(s) + 4H_2(g)$

(c) Manganese will react with 5%. HNO_3 to give hydrogen.

$Mn(s) + 2HNO_3(5\%) \rightarrow Mg(NO_3)(aq) + H_2(g)$

6. Explain the following statements:

(a) Most metal oxides are insoluble in water but some of these dissolve in water called?

(b) At ordinary temperature the surface of metals such as magnesium, aluminium, zinc, etc, is covered with a thin layer. What is the composition of this layer? State its importance.

(c)Some alkali metals can be cut with knife.

Ans. (a) Solution of metal oxides in water is called alkali(soluble base), e.g. sodium hydroxide (NaOH), potassium hydroxide (KOH).

(b) This layer is oxide layer. It makes the metal less reactive(passive) and makes it more useful because it cannot get corroded and remains as it is.

(c)It is because these metals are very soft, e.g. sodium metal can be cut with a knife.

7. (a) What are amphoteric oxides? Choose the amphoteric oxides from amongst the following oxides.

Na_2O, ZnO, Al_2O_3, CO_2, H_2O

(b) Why is that non-metal do not displace hydrogen from dilute acids?

Ans. (a) Those oxides which are both acidic as well as basic are called amphoteric oxides, e.g.Al_2O_3, ZnO.

(b) It is because non-metals do not supply electrons to change H^+ ions into hydrogen gas.

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 related metal.

Ans. It is concentrated by froth-floatation process.

(i) Roasting: The concentrated sulphide ore is heated strongly in the presence of oxygen to convert it into its oxide.

(ii) Reduction : This oxide of metal is reduced with suitable reducing agent to get free metal.

$$ZnO(s) + C(s) \xrightarrow{heat} Zn(s) + CO(g)$$

9. Name the following:

(a) (i) A metal, which is preserved in kerosene.

(ii) A Lustrous coloured non-metal.

(iii) A metal, which can melt while kept on palm.

(iv) A metal, which is a poor conductor of heat.

(b) Give two example each of the metals that are good conductors and poor conductor of heat respectively.

Ans. (a) (i) Sodium is preserved in kerosene.

(ii) iodine is Lustrous coloured non-metal.

(iii) Gallium

(iv) Lead

(b) Good conductor of heat are copper and silver. Poor conductors of heat are lead and mercury.

10. (a) The way, metal like sodium, magnesium and iron react with air and water is an indication of their relative positions in the ' reactivity series'. Is this statement true? Justify your answer with example.

(b) Name a metal/ non-metal:

(i) Which makes iron hard and strong?

(ii) Which is alloyed with any other metal to make an amalgam?

(iii) Which is used to galvanise iron articles?

(iv) Whose articles when exposed to air form a black coating?

Ans. (a) Yes, sodium reacts explosively even with cold water, it is most reactive. Magnesium reacts with hot water, it is less reactive than Na. Iron reacts only with steam which shows it is least reactive.

(b) (i) Carbon makes iron hard and strong. Tungsten can also make iron hard and strong.

(ii) Mercury

(iii) Zinc

(iv) Silver

11. (a) Given reason for the following:

(i) Metal can be given different shapes according to our needs.

(ii) Hydrogen is not evolved when a metal reacts with dilute nitric acid.

(b) Write chemical equations that shows aluminium oxide reacts with acid as well as base.

Ans. (a) (i) Metal are malleable, therefore, they can be given different shapes. They have strong metallic bonds.

(ii) It is because dil HNO_3 is oxidising agent, that is hydrogen is not formed rather H_2O and NO is formed

$3Cu(s) + 8HNO_3(dil) \rightarrow 3Cu(NO)_3 + 2NO + 2H_2O$

(b) $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

12. (a) A copper plate was dipped into a solution of silver nitrate. After sometime a block layer was observed on the surface of copper plate. State the reason for it and write chemical equation for the reaction involved.

(b) When a metal X is treated with cold water, it gives a base Y with molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X,Y and Z.

Ans. (a) Copper is more reactive than Ag, therefore, displace Ag from $AgNO_3$ solution.

$Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2\ (aq) + 2Ag(s)$

(Black layer)

(b) $2Na + 2\ H_2O \rightarrow 2NaOH + H_2(g)$

'X' 'Y' 'Z'

13. (a) Write one example of each of

(i) A metal which is so soft that, it can be cut with knife and a non-metal which is the hardest substance.

(ii) A metal and a non –metal which exist s liquid at room temperature.

(b) Using the electronic configurations, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electrons.

Ans. (a) (i) Sodium, carbon (diamond)

(ii) mercury is liquid metal, bromine is liquid non-metal.

(b) Mg(12) = 2,8,2 $Mg \rightarrow Mg^{2+} + 2e^-$

2,8,2 2,8

O(8) = 2,6 $O + 2e^- \rightarrow O^{2-}$

2, 6 2,8

(Mg^{2+}) $(\ddot{O}^{2-})$

14. A Student has been collecting silver coins and copper coins. One day she observed a black coating coins. One day she observed a black coating on silver coins and green coating copper coins. Give the chemical name of black and green coating. How are they formed?

Ans. Black coating : Silver sulphide (Ag_2S)

Green coating: Basic copper carbonate [$CuCO_3.\ Cu(OH)_2$]

By the action of

(i) H_2S or sulphur compounds present in the atmosphere.

(ii) Carbon dioxide, oxygen and water vapours present in the atmosphere.

15. (a) Describe the process of anodising.

(b) What is 24 carat gold? How will you convert it into 18 carat gold?

Ans. (a) It is a process in which cleaned aluminium metal is taken as anode. Dilute H_2SO_4 acts as electrolyte. When electric current is passed, O_2 gas is liberated which reacts with a aluminium to form a layer of aluminium oxide.

The oxide layer can be made coloured like red, blue, etc., so as to make it more attractive for making decorative articles.

Metal burns in presence of oxygen to form metal oxide. Let us perform an experiment.

(b) 24 carat gold is pure gold. It is converted into 18 carat gold by adding 6 parts of Copper to 18 parts of Gold, i.e.75% Au and 25% Cu.

16. What is meant by reactivity series of metals? State which of the following chemical reactions will take place giving suitable reactions will take place giving suitable reason for each.

(a) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

(b) $Fe(s) + ZnSO_4(aq) \rightarrow FeSO_4(aq) + Zn(s)$

(c) $Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$

Ans. Reactivity series is a series of metals arranged in the order of their decreasing reactivities(activities).

(a) Reaction will take place because Zn is above Cu in the activity series and is more reactive than Cu.

(b) Reaction will not take place as Fe is below Zn in the activity series and cannot displace Zn from its solution.

(c) Reaction will take place because Zn is more reactive than Fe.

17. (a) What is reactivity series? How does the reactivity series help in predicating the relative activity of various metal?

(b) Suggest different chemical processes used for obtaining a metal from its oxides of metals in the middle and top of reactivity series. Support your answer with one example.

Ans. (a) The series of metals in decreasing order of reactivity is called reactivity series of metals. The metals at the top are most reactive and metals at the bottom are least reactive.

(b) The metals in the middle of reactivity series are obtained from their ores by chemical reduction with suitable reducing agent, e.g.

ZnO + C aa Zn + CO

The metal at the top of series are obtained by electrolytic reduction of their molten ore.

Al_2O_3 electrolysis $2Al^{3+} + 3O^{2-}$

Molten

At cathode: $2Al^{3+} + 6e^- \rightarrow 2Al$

At cathode: $O^{2-} - 2e^- \rightarrow O$

$O + O \rightarrow O_2$

18. You are given samples of three metals: Sodium magnesium and copper. Suggest any activities to arrange them in order of decreasing activity.

Ans. Activity 1: Sodium reacts with cold water to form sodium hydroxide and hydrogen gas.

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

Cold

Magnesium does not react with cold water but with hot water to form magnesium hydroxide and hydrogen gas.

$Mg(s) + 2H_2O \rightarrow Mg(OH)_2(aq) + H_2(g)$

Hence sodium is more reactive than magnesium

Activity 2 : $Mg(s) + CuSO_4(aq) \rightarrow MgSO_4$

(aq) + Cu(s)

$Cu(s) + MgSO_4(aq) \rightarrow$ No reaction

So magnesium is more reactive than copper. Concluding from activity 1 and 2 Na >Mg > Cu.

19. (a) How the metals at the top of the reactivity series can be extracted from their ores? Explain with an example.

(b) Name any one alloy made from

(i) a metal and a non-metal, and

(ii) two metals

Ans:

(a) These metals are extracted by electrolytic reduction e.g., aluminium is obtained from bauxite by electrolytic reduction.

(b) (i) Steel is made up of Iron and Carbon.

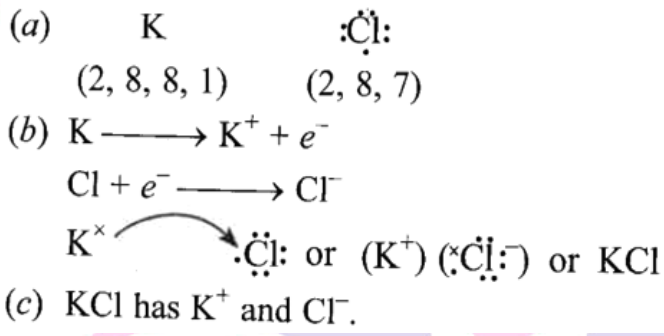
(ii) Brass is made up of Copper and Zinc.

20. (a) Write the electron dot structures for potassium and chlorine.

(b) Show the formation of KCl by the transfer of electrons.

(c)Name the ions present in this compound, KCl.

Ans.

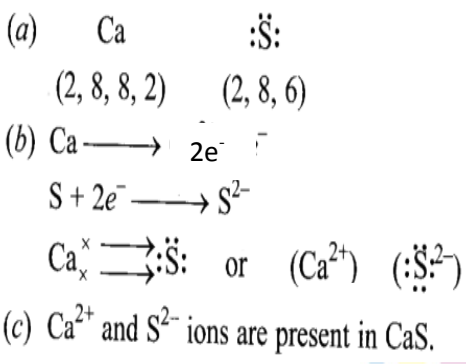


21. (a) State the electron-dot structure for calcium and sulphur.

(b) show the formation of CaS by the transfer of electrons.

(c)Name the irons present in this compounds CaS[Atomic number of Ca=20,O = 16]

Ans.



22. (a) Explain the formation of ionic compound CaO with electron dot structure.

Atomic number of calcium and oxygen are 20 and 8 respectively.

(b) Name the constituent metals of bronze.

Ans.

(*a*) $Ca \longrightarrow Ca^{2+} + 2e^-$

2, 8, 8, 2 2, 8, 8

$O + 2e^- \longrightarrow O^{2-}$

2, 6 2, 8

$(Ca^{2+})\ (:\ddot{O}:^{2-})$

(*b*) Bronze is made up of copper and tin.

23. (a) Show the formation of Na_2O by the transfer of electrons between the combining atoms.

(b) Why are ionic compounds usually hard?

(c) How is it that ionic compounds in the solid state do not conduct electricity but they do so when in molten state?

Ans.

(*a*) $Na\cdot + Na\cdot + :\ddot{O}: \longrightarrow (Na^+)_2\ (:\ddot{O}:^{2-})$

(b) It is due to strong force of attraction between oppositely charged ions.

(c) In solid state, ions are not free to move whereas in molten state ions are free to move, therefore, they conduct electricity in molten state.

24. No reaction takes place when granules of a solid 'A' are mixed with a powder solid 'B'. However when the mixture is heated, a reaction starts with evolution of much heat. Product 'C' of the reaction settles down as a liquid metal and solid product 'D' keeps floating over the liquid 'C'. This reaction is sometimes used for making metals for ready use in odd places.

(i) Based on this information, make assumptions about 'A' and 'B' and corresponding blanaced in the chemical equations about physical states of the reactants and products, need of heating for starting the reactions to which this reaction can belong.

Ans. (i) 'A' is aluminium, 'B' is ferric oxide (Iron(III) oxide).

$2Al(s) + Fe_2O_3(s) \xrightarrow{heat} Al_2O_3(s) + 2Fe(l) + heat$

'A' 'B' 'D' 'C'

(ii) This reaction is displacement reactions because 'Al' is displacing 'Fe'. It is also a redox reaction because 'Al' is reducing agent and Fe_2O_3 is oxidising agent.

25. State reasons for the following:

(a) Electric wires are covered with rubber like material.

(b) From dilute hydrochloric acid, zinc can liberate hydrogen gas but copper cannot.

(c)Sulphide ore of a metal is first converted to its oxide to extract the metal from it.

Ans. (a) It is because rubber is an insulator and does not allow current to flow through it.

(b) Zinc is more reactive than hydrogen. Therefore, it can displace hydrogen from dilute HCl whereas copper cannot, because, it is less reactive than hydrogen.

(c)It is because it is easier to reduce oxide ore as compared to sulphide ore.

26. What is cinnabar? How is metal extracted from cinnabar? Explain briefly.

Ans. Cinnabar is HgS.

Mercury is obtained by roasting cinnabar. HgO formed is themelly unstable and gives mercury.

$2HgS(s) + O_2(g) \rightarrow HgO(s) + SO_2(g)$

$2HgO(s) + \text{heat} \rightarrow Hg(l) + O_2(g)$

$HgS(s) + O_2(g) \rightarrow Hg(l) + SO_2(g)$

Mercury can be purified by distillation.

27. Suggest a method of reduction for the following metals during their metallurgical processes:

(a) metal 'A' which is one of the last second or third position in the reactivity.

(b) metal 'B' which gives vigorous reaction even with water and air.

(c) metal 'C' which is kept in the middle of activity series.

Ans. (a) 'A' c an be obtained by chemical reduction by using carbon or carbon monoxide as reducing agent.

(b) 'B' can be obtained by electrolytic reduction.

(c) 'C' can be reduced by reducing agent like 'Al'.

28. A metal 'X' acquires a green colour coating on its surface on exposure to air.

(a) Identify the metal 'X' and name the process responsible for this change.

(b) Name and write chemical formula of the green coating formed on the metal.

(c) List two important methods to prevent the process.

Ans. (a) Metal is copper. The process is corrosion.

(b) Basic copper carbonate [$CuCO_3$, $Cu(OH)_2$

(c) It should be coated with tin. It should be mixed with other metals to form alloys.

29. What meant by 'rusting'? With labelled diagrams, describe an activity to find out the conditions under which iron rusts.

Ans. The process in which iron reacts with oxygen in the presence of moisture to form reddish brown coating of hydrated ferric oxide [iron(III) oxide]. $Fe_2O_3.xH_2O$

For activity of iron rusts refer to NCERT Activity 7 of this chapter. Activity should be here

30. Give reasons for the following:

(a) Silver and copper lose their shine when they are exposed to air. Name the Substance formed on their surface in each case.

(b) Tarnished copper vessels are cleaned with tamarind juice.

(c) Aluminium is more reactive than iron yet there is less corrosion of aluminium as compared to iron when both are exposed to air.

Ans. (a) These metals get corroded. Silver forms black Ag_2S (silver sulphide) and copper form greenish layer of basic copper carbonate $CuCO_3.Cu(OH)_2$.

(c) Tamarind contains acid which reacts with basic copper carbonate and product gets dissolved and removed from copper vessel.

(c) Aluminium forms oxide layer on its surface which does not further react with air.

31. What is purpose of making alloys?

Ans. (i) Alloys do not get corroded or corroded to very less extent.

(ii) They are harder and stronger than pure metal. E.g., gold mixed with copper is harder than spore gold.

(iii) They have less conductance than pure metals, e.g., copper is good conductor of heat and electricity whereas brass and bronze are not good conductors.

(iv) Some alloys have lower melting point than pure metals, e.g solder is an alloy of led and tin which has lower melting point than each of the metals. It is used for soldering of metals.

32. The following observations were made by a student on treating four metals P,Q,R and S with the given salt solutions:

Sample	$MgSO_4(aq)$	$Zn(NO_3)_2(aq)$	$CaSO_4(aq)$	$Na_2SO_4(aq)$
P	No reaction	Reaction occurs	Reaction occurs	No reaction
Q	Reaction occurs	Reaction occurs	Reaction occurs	Reaction occurs
R	No reaction	Reaction occurs	No reaction	No reaction
S	No reaction	No reaction	No reaction	No reaction

Based on the above observations:

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

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

Ans. (a) S > R > P >Q

(b) Cu and QSO_4

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

Ans.

Silver	Sulphur in air	Silver sulphide
Copper	Moisture and carbon dioxide	Copper carbonate

Detailed Answer:

Silver articles become black when kept in open for some time, whereas copper vessel loses their shiny brown surfaces and gain a green coat when kept in open because silver articles react with sulphur compounds such as hydrogen sulphide present in the air to form black silver sulphide (Ag_2S) whereas copper reacts slowly carbon dioxide (CO_2) and water present in the air to form a green coating of a mixture of copper carbonate and copper hydroxide.

34. Give reasons:

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

(b) Aluminium is a highly reactive metal; still it is widely used in making cooking utensils.

Ans. (a) It is easier to obtain a metal from its oxide as compared to sulphide and carbonate ore.

(b) Aluminium forms a thicker protective oxide[Fe_2O_3] with heated aluminium is used to join cracked machine parts.

35. Give reasons for the following:

(a) most metals conduct electricity well.

(b) The reaction is used to join cracked machine parts.

Ans. (a) Metals have loosely bound electrons / Loose electrons easily free electrons.

(b) The thermite reaction is used. Molten iron produced during reaction joins the cracked machine parts.

36. Explain why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some tie when immersed water.

Ans. Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of metal.

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

Magnesium reacts with hot water and starts floating due to the bubbles of hydrogen gas sticking to its surface.

37.Give reasons for the following reactivity and write three main steps in the extraction of this metal from its sulphide ore.

(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.

Ans. (i) Ionic compounds have melting and boiling points due to strong force f attraction between oppositely charges ions.

(ii) It is because these metal, themselves are strong reducing agents. Therefore, cannot be reduced by reducing agent like carbon.

Short Answer Type Questions - II (3 marks each)

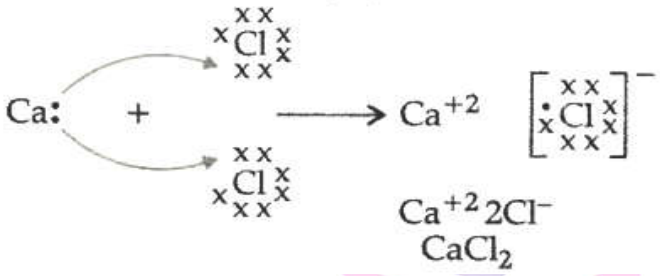
1. Explain the formation of Calcium chloride with the help of electron dot structure. (AT numbers: Ca = 20; Cl = 17)

(b) Why do ionic compounds not conduct electricity in solid state but conduct electricity in molten and aqueous state?

Ans.

(a)

	Z	E.C.
Ca	= 20	2 8 8 2
Cl	= 17	2 8 7



(b) Ionic compounds do not conduct electricity in solid state due to absence of free ions but they conduct electricity in molten and aqueous state due to presence of free ions.

2. An ore on treatment with dil. HCl gives the smell of rotten egg. Name the type of this ore. How can the metal be obtained from its concentrated ore?

Ans. The gas which smells like that of rotten eggs is H_2S. Hence, the ore is a sulphide ore.

It is concentrated by froth-floatation process. The metal is obtained from the concentrated ore in the following two steps:

(i) Roasting: Heating the ore strongly in the presence of air. The metal sulphide is converted into metal oxide along with evolution of sulphur dioxide gas.

(ii) Reduction with carbon: On heating the metal oxide with carbon, it is reduced to free metal.

$$ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$$

3. Given below are the steps for the extraction of copper from its ore. Write the chemical equation of the reaction involved in each case.

(a) Roasting of copper (I) sulphide

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

(c) Electrolytic refining.

Ans. (a) $2cu_2S + 3O_2 \xrightarrow{Heat} 2Cu_2O + 2SO_2$

(b) $2Cu_2O + Cu_2S \xrightarrow{Heat} 6Cu + SO_2$

(c) At anode: $Cu \rightarrow Cu^{2+} + 2e^-$

At cathode: $Cu^{2+} + 2e^- \rightarrow Cu$

Detailed Answer:

(a) Roasting of copper (I) sulphide:

$2Cu_2O(s) + Cu_2S(s) \xrightarrow{Heat} 6Cu(s) + SO_2(g)$

(b) Reduction of copper (I) oxide from copper (I) sulphide:

$2Cu_2O(s) + Cu_2S(s) \xrightarrow{Heat} 6Cu(s) + SO_2(g)$

Copper oxide Copper sulphide

(c) Electrolytic refining:

At anode : $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$

At cathode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

4. 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 can be identify the produced gas. Write chemical equations for both the reactions.

Ans:

$M + 2NaOH \rightarrow Na_2MO_2 + H_2(g)$

$M + 2HCl \rightarrow MCl_2 + H_2(g)$

Bring a burning candle near the gas. If it burns with pop sound, the gas is hydrogen and the element is a metal.

5. **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, where to we get pure silver after passing electric current?

Ans. (a) Pure silver rod will be used as cathode and impure silver rod will be used as anode.

(b) $AgNO_3(aq)$ can be used as electrolyte.

(c) Pure silver will be formed at cathode.

At anode : $Ag \rightarrow Ag^+ + e^-$

At cathode : $Ag^+ + e^- \rightarrow Ag$

6. Why should the 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?

Ans. It is because HNO_3 is an oxidising agent and it gets reduced to NO if it is dilute and NO_2 if HNO_3 is concentrated, it oxidise H_2 to H_2O.

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

(a) Identify the compound X.

(b) Name the reaction.

(c)Write down its reaction.

Ans. (a) 'X' is Fe_2O_3.

(b) It is called thermite reaction.

(c) $2Al(s) + Fe_2O_3(s) \rightarrow Al_2O_3(s) + 2Fe(l) + heat$

(molten)

Molten iron is used to form broken railway tracks.

8. 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.

Ans. Both sodium (Na) and potassium (K) react with cold water to give basic salt NaOH is 40 (23 + 16 + 1 = 40). Therefore, Y is NaOH and the gas liberated reaction is hydrogen. Thus, Z is H_2.

$2Na + 2H_2O \rightarrow 2NaOH + H_2 + Heat\ energy.$

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

$2MnO_2(s) + 4Al(s) \rightarrow 3Mn(l) + 2Al_2O_3(l) + Heat$

(Molten) (Molten)

(a) Is aluminium getting reduced?

(b) Is MnO_2 getting oxidised?

Ans. (a) NO, aluminium is getting oxidised.

(b) No, MnO_2 is getting reduced.

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

Ans. Solder is made up of lead and tin. It has low melting point, therefore, it is used for soldering(welding) electrical wires.

11. 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.

Ans. 'A' is aluminium.

$4Al(s) + 3O_2(g) \xrightarrow{heat} 2Al_2O_3(s)$

'B' is Al_2O_3, amphoteric in nature.

$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 2H_2O$

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

12. A metal that exists as 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.

Ans. The metal is mercury.

$2HgS(s) + 3O_2(g) \rightarrow 2HgO(s)\ 2O_2(g)$

$HgS(s) + 2HgO(s) \rightarrow 3Hg(l) + SO_2(g)$

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

a. Mg and N_2 **b. Li and O_2** **c. Al and Cl_2** **d. K and O_2**

Ans. a. $3Mg + N_2 \rightarrow Mg_3N_2$

b. $4Li + O_2 \rightarrow 2Li_2O$

c. $2Al + 2Cl_2 \rightarrow 2AlCl_3$

d. $4K + O_2 \rightarrow 2K_2O$

14. What happens when

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

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

Ans. (a) Zinc oxide(s) and $CO_2(g)$ are formed.

$ZnCO_3(s) \xrightarrow{heat} ZnO(s) + CO_2(g)$

(b) Blister copper(s) and $SO_2(g)$ are formed.

$2Cu_2O(s) + Cu_2S(s) \xrightarrow{heat} 6Cu(s) + SO_2(g)$

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

(a) Identify A,B and C.

(b) To which group of periodic table does A belong?

Ans. (a) 'A' is carbon. It forms two oxides: CO (B) is toxic whereas CO_2 (C) causes global warming as it absorbs heat radiations from atmosphere.

(b) 'A' belongs to group 14 of periodic table.

16. 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.

Ans. $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

'A' 'B'

'B' $Ca(OH)_2$ is used in white washing.

$Ca(OH)_2(aq) \xrightarrow{heat} CaO(s) + H_2O(l)$

'B' 'C'

'A' is calcium metal 'B' is calcium hydroxide, 'C' is calcium oxide.

17. 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.

Ans. M is 'Cu'. It does not liberate hydrogen with dilute acid as it is less reaction than hydrogen gas.

$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$

'M' Copper oxide(Black)

18. 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 .

Ans. Iron is more reactive then copper. Therefore, it displaces copper from copper solution.

$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

(Blue) (Green) (Reddish brown)

Long Answer Type Questions

(5 marks each)

1. **(a) What is thermite process? Where is this process used? Write balanced chemical equation for the reaction involved.**

   (b) Where does the metal aluminium, used in the process occurs in the reactivity series of metals?

   (c) Name the substances that are getting oxidised and reduced in the process.

Ans. (a)

The highly exothermic displacement reaction between iron oxide and aluminium powder.

It is used to join railway tracks or cracked machine parts.

$Fe_2O_3(S) + 2\ Al(s) \rightarrow Fe(l) + Al_2O_3(S) + Heat$

(b) It is placed above iron/towards top in the reactivity series.

(c) Oxidized → Al

Reduced → Fe_2O_3

Detailed Answer:

(a) Thermite reaction: Reaction in which iron oxide reacts with aluminium to produce molten iron. It is an exothermic process. $Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(I) + Al_2O_3(s) + Heat$

The thermite reaction is used to join railway tracks or cracked machine parts. This process is called thermite welding.

(b) As aluminium is more reactive than iron, so it is placed above iron in the reactivity series.

(c) Aluminium is getting oxidized to aluminium oxide and iron oxide is getting reduced to iron.

2. **Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals. Why? Where are these metals placed in the reactivity series? How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations.**

   Ans. These metals have more affinity for oxygen than carbon.

Towards the top of the reactivity series.

By electrolytic reduction of their molten ores.

Example: Extraction of sodium from molten sodium chloride by electrolysis.

Process:

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

Reactions_

At cathode_ $Na^+ + e^- \rightarrow Na$

At anode_ $2Cl^- \rightarrow Cl_2 + 2e$

3. Write balanced chemical equations to explain what happens, when

(a) Mixture of cuprous oxide and cuprous sulphide heated.

(b)Aluminium is reacted with manganese dioxide.

(c) Ferric oxide is reduced with aluminium.

(d) Zinc carbonate undergoes calcinations.

Ans.

(a) $2Cu_2O + 2Cu_2S \xrightarrow{heat} 6Cu + SO_2$

(b) $3MnO_2 + 4\ Al \rightarrow 2Al_2O_3 + 2Mn + heat$

(c) $Fe_2O_3 + 2Al \xrightarrow{heat} Al_2O_3 + 2Fe + heat$

(d) $ZnCO_3 \rightarrow ZnO + CO_2$

Detailed Answer:

(a) When mercury oxide is heated strongly, it reduces to mercury metal.

$2HgO \xrightarrow{heat} 2Hg + O_2$

(b) When a mixture of copper oxide and copper sulphide is heated, pure copper is obtained.

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(c) When aluminium power is heated with manganese dioxide, the following reaction takes place:

$3MnO_2(s) + 4Al(s) \rightarrow 3Mn(l) + 2Al_2O_3(s) + heat$

(d) Reaction of ferric oxide with aluminium: In this reaction, a lot of heat is produced along with molten iron. This process of metal oxide to form metal by using aluminium powder as a reducing agent is known as thermite reaction.

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$:

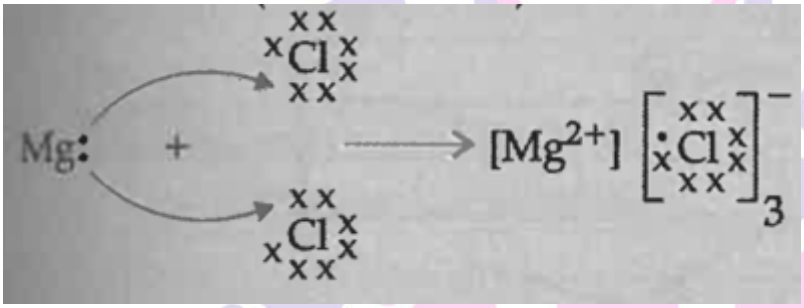
4. (a) By the transfer of electrons, illustrate the formation of bond in magnesium chloride and identify the ions present in this compound.

(b) Ionic compounds are solids. Give reasons.

(c) With the help of a labelled diagram show the experimental set up of action of steam on a metal.

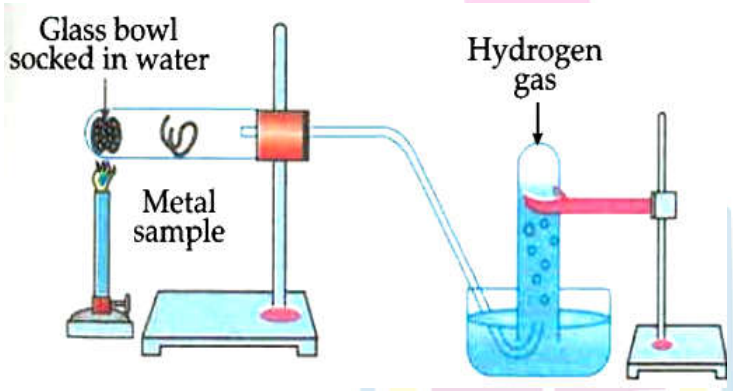
Ans.

(a) $Mg \rightarrow Mg^{2+} + 2e^-$
2,8,2 2,8
(Magnesium cation)
$Cl + e^- \rightarrow Cl^-$
2,8,7 2,8,8
(Chloride anion)



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

(c)



Detailed Answer

(a) Formation of magnesium chloride:

Here, magnesium is a metal and chlorine is a non-metal. Magnesium atom loses two electrons to attain noble gas configuration and results in the formation of magnesium cation Mg^{2+}. Similarly, chlorine atom gains electron to complete its octet and results in the formation of chloride anion Cl^-. When magnesium reacts with chlorine, two electrons

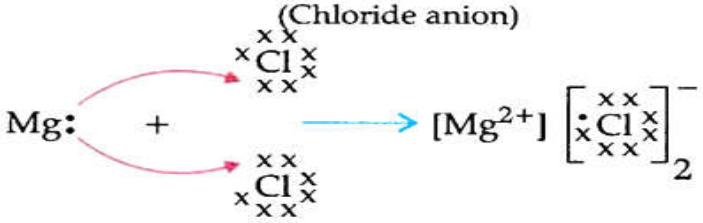
lost by magnesium atom are gained by two chlorine atoms. Mg^{2+} and Cl^- being oppositely charged, attract each other and held by strong electrostatic forces of attraction to exist as $MgCl_2$.

$$\underset{2,8,2}{Mg} \rightarrow \underset{2,8}{Mg^{2+}} + 2e^-$$

(Magnesium cation)

$$\underset{2,8,7}{Cl} + 1e^- \rightarrow \underset{2,8,8}{Cl^-}$$

(Chloride anion)



(b) Due to the strong force of attraction between the positive and negative ions, ionic compounds are solid.

(c) Reaction with steam: Metals like iron, zinc and aluminium react with steam to form corresponding oxide and hydrogen gas. (For figure refer marking scheme answer)

5. (a) Write electron dot structures of Ca (Atomic no.20) and O (Atomic no.8).

(b) Show the formation of calcium oxide by transfer of electrons.

(c) Name the ions present in this compound.

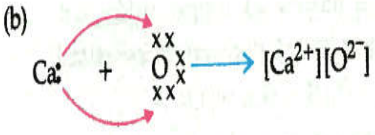
(d) List four important characteristics of this compound.

Ans. (a)

(a) Ca (atomic number 20) = 2,8,8,2

(atomic number 8) = 2,6

(b)



(c) Calcium ions, oxide ion

(d)

- Solid
- High melting point and boiling point
- Soluble in water
- Conducts electricity in molten
- Conducts electricity in molten state

6. Metal X is found in nature as its sulphide XS. It is used in the galvanisation of iron article. Identify the metal X. How will you convert this sulphide ore into the metal? Explain with equations.

Ans. Metal X is Zinc

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

$2ZnS + 3O_2 \xrightarrow{heat} 2ZnO + 2SO_2$

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

$2ZnO + C \rightarrow 2Zn + CO_2$

7. State the reason for the following:

(a) Aluminium oxide is called an amphoteric oxide.

(b) An iron strip dipped in a blue copper sulphate solution turns blue pale green solution.

(c) Hydrogen gas is not evolved when most metals react with nitric acid.

(d) Calcium does not occur in free state in nature.

(e)Sodium and potassium metals are kept immersed under kerosene.

Ans. (a) As it react with both acids as well as bases to form salts.

(b) Iron being more reactive than copper displaces copper from copper sulphate to form green ferrous sulphate solution.

(c) Nitric acid is a strong oxidising agent. Hydrogen gas produced get oxidised to H_2O.

(d) Calcium is a very reactive metal. It react with the chemicals in surrounding and occurs in combined state.

(e) Sodium and potassium are highly reactive metals and react vigorously with oxygen in air and may even catch fire. They do not react with kerosene.

8. (a) How will you show experimentally that metals are good conductors of heat.

(b) Describe the extraction of Mercury metal from its ore cinnabar(HgS).

Ans. (a) Diagrams (Refer Detailed Answer) Procedure.

Observation: Heat is transferred from one end of metal wire to the free end of wire which melts the wax and pin falls shows metals conduct heat.

(b) Ore: HgS- cinnabar

Roasting: $2HgS(s) + 3O_2(g) \rightarrow 2HgO(s) + 2SO_2(g)$

(Cinnabar) (Air) Mercury oxide Sulphur dioxide

Reduction: $2HgO \xrightarrow{\Delta} 2Hg(l) + O_2(g)$

Mercuric(II) oxide mercury metal oxygen

9. (i) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.

(ii) How is copper extracted from its sulphide ore? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

Ans. (i) (a) Calcination, (b) Reduction, (c) Purification (in the given sequence only)

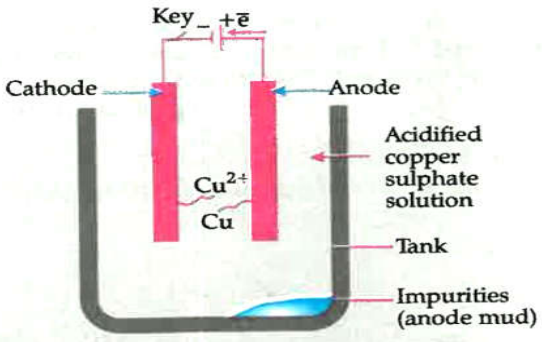
(ii) Sulphide ore of copper is heated in air.

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(Note: Full marks to be awarded even when only equations are written).

Labelled diagram of electrolytic refining of copper.



Electrolytic refining of copper

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

(b) Name the constituents of the following alloys:

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

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

Ans. (a) An alloy is a homogeneous mixture of two or more metals or a metal and a non-metal, mixed in the molten state. Amalgam is an alloy of a metal with mercury.

Solder is the alloy used for the welding of electric wires. Tines and Lead are its constituents.

(b) (i) Brass- copper and zinc

(ii) Stainless steel – Iron, carbon, nickel, chromium

(iii) Bronze – copper and tin

Brass and bronze have lower electrical conductivity than their constituents. Stainless steel does not corrode easily as iron does.

11. A metal 'M' is stored under kerosene. It vigorously catches fire, if a small piece of this metal in water release great amount of energy and the metal catches fire. The solution so formed turns red Litmus blue.

(a) Name the metal 'M' .

(b) Write formula of the compound formed when this metal is exposed to air.

(c)Why is metal 'M' Stored under kerosene?

(d) If oxide of this metal is treated with hydrochloric acid, what would be the products?

(e)Write balanced equations for:

(i) Reaction of 'M' with air.

(ii) Reaction of 'M' with water.

(iii) Reaction of metal oxide with hydrochloric acid.

Ans.

(a) Sodium

(b) Na_2O

(c)It catches fire, if kept in open

(d) NaCl and H_2O

(e)(i) $4M + O_2 \rightarrow 2M_2O$

(ii) $2M + 2H_2O \rightarrow 2MOH + H_2 +$ Heat energy.

(iii) $M_2O + 2HCl + 2MCl + H_2O$

Detailed Answer :

(a) Metal M is sodium (Na).

(b) Formula of the compound formed is Na_2O.

(c) Metals like sodium and potassium react with oxygen so fast that they can catch fire if kept open. Since, they are most reactive metals; they are always kept immersed in kerosene oil to prevent accidental fire.

(d) Sodium oxide reacts with hydrochloric acid to produce sodium chloride and water.

(e) (i) Reaction with air:

$4\ Na + O_2 \rightarrow 2Na_2O$

(ii) Reaction with water:

$2NaO(s) + 2HCl(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2(g)$ + heat energy

(iii) Reaction of sodium oxide with HCl:

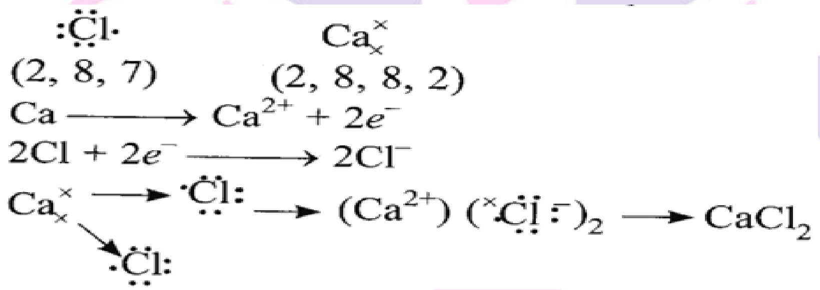
$Na_2O(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l)$

12. (a) Write electron dot structure for chlorine (At No. 17) and calcium (At No. 20). Show the formation of calcium chloride by the transfer of electrons.

(b) Identify the nature of the above compound and explain three physical properties of such compounds.

Ans.

(a)



(b) It is ionic compound.

Physical properties

(i) It is hard and solid.

(ii) It has high melting and boiling point.

(iii) It is soluble in water.

13. (a) In the formation of compound between two atoms A and B, A loses two electrons and B gains one electron.

(i) What is the nature of bond between A and B?

(ii) Suggest the formula of the compound formed between A and B.

(b) On similar lines explain the formation of $MgCl_2$ molecule.

(c) Common salt conducts electricity only in the molten state. Why?

(d) Why is melting point of NaCl high?

Ans.

(a) (i) Ionic Bond (ii) (A^{2+}) $(:\ddot{B}:^{-})_2$ i.e. AB_2

(b) $Mg \longrightarrow Mg^{2+} + 2e^-$

$2Cl + 2e^- \longrightarrow 2Cl^-$

(Mg^{2+}) $(:\ddot{Cl}:^{-})_2$

(c) Na^+ and Cl^- are free to move in molten state but not in solid state.

(d) It is due to strong force of attraction between Na^+ and Cl^-.

14. Write the names and symbols of two most reactive metals. Explain by drawing electronic structure how any one of the two metals react with a halogen. State any four physical properties of the compound formed.

Ans. K (Potassium) and Na (Sodium) are two highly reactive metals.

K^+ and Na^+ are electronic structures as they have one valence electron.

KCl will be the compound formed.

$K \longrightarrow K^+ + e^-$

$Cl + e^- \longrightarrow Cl^-$

(i) It has high melting point.

(ii) It is soluble in water.

(iii) It conducts electricity in molten state not in solid state.

(iv) It is solid and some what hard

15. (a) Define activity series of metals. Arrange the metals gold, copper, iron and magnesium in order of their increase in reactivity.

(b) What will you observe when:

(i) Some zinc pieces are put in copper sulphate solution.

(ii) Some silver pieces are put into green coloured ferrous sulphate solution.

Ans. The series of metals in which metals are arranged in decreasing order of their reactivity.

Au < Cu < Fe< Mg is increasing order of reactivity.

(b) (i) The blue solution will become colourless and reddish brown copper metals will be deposited.

$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

(Blue) (colourless) (reddish brown)

(ii) $Ag(s) + FeSO_4(aq) \rightarrow$ No reaction

Reaction will not take place because 'Ag' is less reactive than iron.

16. (a) Differentiate between roasting and calcinations. Explain the two with the help of suitable chemical equations. How is zinc extracted from its ore?

(b) Name two metals that can be used to reduce metals oxides to metals.

Ans. (a)

Calcination	Roasting
It is a process in which carbonate ore is heated in absence of air to form oxide. $ZnO_3(S) \xrightarrow{heat} ZnO(s) + CO_2(g)$	It is process in which sulphide ore is heated in presence of oxygen to convert into oxide. $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

By reduction process, Zn can be extracted from its ore.

Reduction.

$ZnO + C \rightarrow Zn + CO_2$

(b) Aluminium, Magnesium

17. (a) Mention the names of the metals for the following:

(i) Two metals which are alloyed with iron to make stainless steel.

(ii) Two metals which are used to make jewellery.

(b) Explain why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction. Name one more that starts floating after some time when immersed in water.

(c) $X + YSO_4 \rightarrow XSO_4 + Y$

$Y + XSO_4 \rightarrow$ No reaction

Out of the two elements, 'X' and 'Y', which is more reactive and why?

Ans. (a) (i) Nickel and chromium

(i) Gold and platinum

(b) Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of metal.

$Ca(s) + 2H_2O \rightarrow Ca(OH)_2 + H_2(g)$

(c) 'X' is more reactive than 'Y' because it displaces 'Y' from its slat solution.

18. (a) Give reason for the following:

(i) School bells are made up of metals.

(ii) Electric wire are made up of copper.

(b) Elements magnesium and oxygen respectively belong to group 2 and group 16 of the Modern periodic Table. If the atomic numbers of magnesium and oxygen are 12 and 8 respectively, draw their electronic configurations and show their electronic configurations and show the process of formation of their compound by transfer of electrons.

(c) (i)Give two methods prevent the rusting of iron.

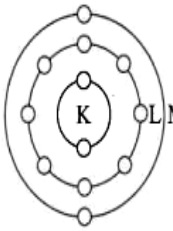
(ii) Name the ores of the following metals:

- **Mercury**
- **Zinc**

Ans. (a) (i) It is because metals are sonorous, i.e. produce sound when struck with a hard substance.

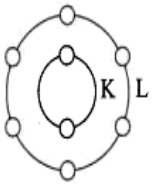
(ii) It is because copper is good conductor of electricity.

(*b*) Mg(12) = 2, 8, 2



K = 2, L = 8, M = 2

O(8) = 2, 6



K = 2, L = 6

Mg: ⟶ Ö: (Mg^{2+}) $(:\ddot{O}:^{2-})$

(*c*) (*i*) • Painting • Galvanisation

(*ii*) • Cinnabar • Zinc Blende

19. How is the method of extraction of metals high up in the reactivity series different from that for metals in the middle? Why the same process cannot be applied for them? Explain giving equations, the extraction of sodium.

Ans. Metals high up in the series are obtained by electrolytic reduction because these metals are strong reducing agents and therefore cannot be obtained by chemical reduction .

Metals in middle of series are less reactive and can be obtained by chemical reduction.

The same process can't be obtained by chemical reduction.

Extraction of sodium is done by electrolysis of molten sodium chloride.

$$2NaCl_{(Molten)} \xrightarrow{electrolysis} 2Na(s) + Cl_2(g)$$

20. (a) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.

(b) How is copper extracted from its sulphide ore? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

Ans. (a) (i) Concentration of ore.

(ii) Calcination

(ii) Reduction

(iii) Purification

(b) (i) ore of copper is concentrated by froth floatation process.

(ii) Roasting:

$2CuFeS_2 + O_2 \rightarrow Cu_2S + FeS + SO_2$

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

$2FeS + 3O_2 \rightarrow 2FeO + 2SO_2$

$FeO + SiO_2 \rightarrow FeSiO_3$

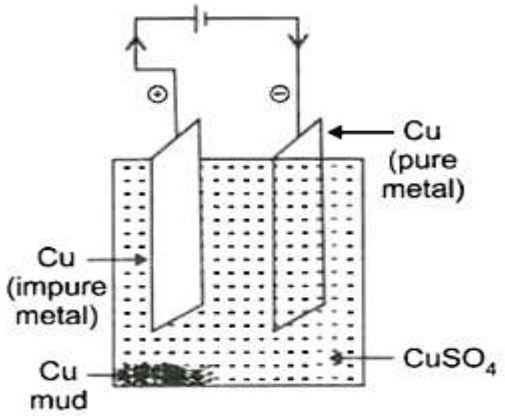
(iii) Smelting:

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(iv)Electrolytic refining : Impure copper is taken as anode, pure copper is taken as cathode. Acidified $CuSO_4$ is taken as electrolyte. Impure copper changes into Cu^{2+} which gain electron at cathode forming pure Cu. Impurities are left behind as anode mud.

At anode Cu (impure) $\rightarrow Cu^{2+} + 2e^-$

At cathode $Cu^{2+} + 2e^- \rightarrow$ Cu (pure)



Electrolytic refining

21. (a) Carbon cannot be used as reducing agent to obtain Mg from MgO. Why?

(b) How is sodium obtained from molten sodium chloride? Give equation of the reactions.

(c)How is copper obtained from its sulphide ore? Give equations of the reactions.

Ans. (a) It is because 'Mg' is stronger reducing agent than carbon.

(b) Electrolysis of Molten NaCl

$2NaCl_{(Molten)} \xrightarrow{electrolysis} 2Na(s) + Cl_2(g)$

(c) Copper ore is concentrated by froth-floatation process.

(d) Roating: $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

Bassemerisation : Copper oxide reacts with Cu_2S on heating to form Blister copper and SO_2.

$Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

Blister Copper is purified by electrolytic refining.

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

(a) Name the metal (E).

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

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

Ans. (a) 'E' is sodium which catches fire in presence of moisture.

(b) $4Na + O_2 \rightarrow 2Na_2O$

$Na_2O + H_2O \rightarrow 2NaOH$

(c)Electrolytic reduction: Electric current is passed through molten NaCl. Sodium is formed at cathode and $Cl_2(g)$ is liberated at anode.

$2NaCl \xrightarrow{\text{electrolysis}} 2Na(s) + Cl_2(g)$

(Molten)

23. (a) An ore on treatment with dilute hydrochloric acid produces brisk effervescence. What step will be required to obtain metal from the enriched ore.

(b) Copper coins is kept immersed in silver nitrate solution for some time. What change will take place in coin and colour of the solution? Write balance chemical equation of the reaction involved.

Ans. (a) Carbonate ore:

Steps

Calcination: Carbonate ore is heated in limited supply of air and oxide is obtained,

e.g.

$ZnCO_3(s) \xrightarrow{\text{heat}} ZnO(s) + CO_2(g)$

(b) Copper, being more reactive than silver will displace silver from silver nitrate solution and there will be deposition of silver on copper coin. The colour of solution will turn to blue, e.g.

$Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$

24. (a) Write the chemical name of the coating that forms on silver and copper articles when these are left exposed to moist air.

(b) Explain what is galvanisation. What purpose is served by it?

(c)Define an alloy. How are alloys prepared? How do the properties of iron change when:

(i) Small quantity of carbon,

(ii) nickel and chromium are mixed when it.

Ans. (a) Ag_2S (silver Sulphide) is formed on silver, Basic copper carbonate $CuCO_3$. $CU(OH)_2$ is formed on copper.

(b) The process of coating zinc over iron is called galvanisation. It is used prevent rusting of iron.

(c) Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal. Alloys are prepared by melting two or more metals together.

(i) Iron does not rust on adding small quantity of carbon.

(ii) When we form alloy of iron with nickel and chromium we get stainless steel which is malleable and does not get rusted.

25. (a) Define corrosion.

(b) What is corrosion of iron called?

(c)How will you recognise the corrosion of silver?

(d) Why corrosion of iron is a serious problem?

(e) How can we prevent corrosion of iron?

Ans. (a) It is a process in which a metal reacts with substances present in air to form surface compounds.

(b) Rusting.

(c) Black layer on its surface due to formation of Ag_2S

(d) It makes the metal weak and brittle, which is serious problem.

(e)Oiling, painting, greasing, galvanisation, alloying can prevent iron from corrosion.

26. Distinguish between metals and non-metals on the basis of (i) two physical and (ii) three chemical properties.

Ans.

Metals	**Non-metals**
Physical: (i) Metals are and malleable and ductile (ii) Metals are good conductor of heat and electricity.	 (i) Non – metals are brittle. (ii) Non – metals do not conduct heat and electricity.
Chemical: (i) Reactive metals displace hydrogen from dilute acids. (ii) Metallic oxides are basic in nature. (iii) Metal can lose electron to form positive ions.	 (i) Non – metallic do not displace H_2 from dilute acids. (ii) Non – metallic oxides are acidic in nature. (iii) Non – metals can gain electrons to form negative ions.

27. Describe the extraction of mercury metal from its ore cinnabar:

Ans. Cinnabar is HgS

(i) It is concentrated by froth floatation process.

(ii) **Roasting:** Cinnabar ore is heated in presence of oxygen to form HgO. HgO reacts with HgS to from mercury.

$2HgS + 3O_2 \rightarrow 2HgO + SO_2$

$HgS + 2HgO \rightarrow 3Hg + SO_2$

or

$2HgO \xrightarrow{heat} 2Hg + O_2$

(iii) Mercury, thus obtained is purified by distillation.

28. A non – metal A which is the largest constituent of air, when heated with H_2 in 1 : 3 ration 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 F 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?

Ans. (a) N_2 is largest constituent of air, when heated with H_2 in the ration of 1 : 3 in the presence of catalyst (Fe) gives a gas NH_3 (B).

$$\underset{\text{'A'}}{N_2(g)} + 3\,\underset{\text{Hydrogen}}{H_2(g)} \xrightarrow[\text{Fe}]{773\ K} \underset{\text{'B'}}{2NH_3(g)}$$

1 : 3

Nitrogen reacts with oxygen on heating to form nitrogen monoxide 'C', which gets oxidised in the presence of O_2 to nitrogen dioxide. Nitrogen dioxide dissolves in water in the presence of oxygen to from nitric acid which is an oxidising agent.

$$N_2(g) + O_2(g) \xrightarrow{heat} \underset{\text{'C'}}{2NO}$$

$$2NO + O_2 \longrightarrow 2NO_2$$

$$4NO_2 + 2H_2O + O_2 \longrightarrow \underset{\text{'D'}}{4HNO_3}$$

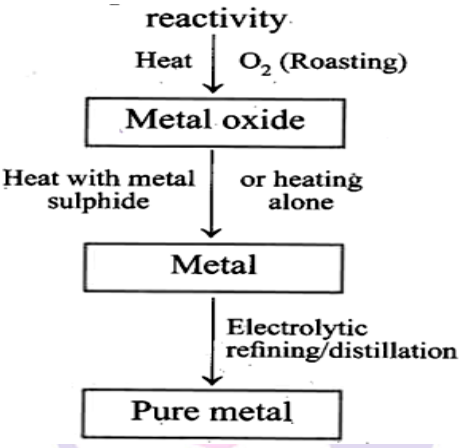
(Nitric acid)

'A' is N_2, 'B' NH_3, 'C' is NO and 'D' is HNO_3

(b) Group 15

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

Ans, (a) Sulphide ores of low



Metal sulphide like HgS reacts with O_2 on heating to from mercuric oxide, HgO and sulphur dioxide Mercuric oxide on further heating gives Hg which can be refined by distillation.

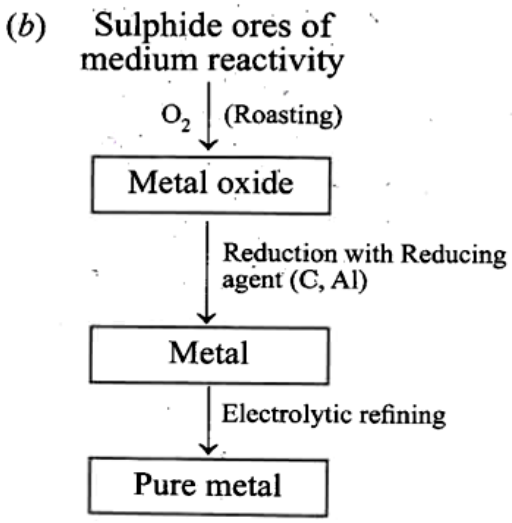
$$2HgO \xrightarrow[\text{Continuously}]{\text{Heating}} 2Hg + O_2$$

In the same manner, copper in copper glance, Cu_2S is found in nature and can be obtained from its ore by heating in air:

$$2Cu_2S + 3O_2 \xrightarrow{\text{Heat}} 2Cu_2O + 2SO_2$$

$$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$$

Pure copper is obtained from electrolytic refining.



Sulphide ore like zinc blende (ZnS) on roasting in the presence of O_2 gives metal oxide. On reduction with suitable reducing agent gives metals which is impure. Impure metal on electrolytic refining gives pure metal.

$$2ZnS + 3O_2 \xrightarrow{\text{Roasting}} 2ZnO + 2SO_2$$

$$ZnO + C \xrightarrow[\text{(Smelting)}]{\text{Reduction}} Zn + CO$$

Coke

Pure zinc is obtained by electrolytic refining.

30. Explain the following:

(a) Reactivity of Al decreases if it 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 article are galvanised.

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

Ans. (a) It is due to the formation of oxide layer on its surface.

(b) It is because Na or Mg are strong reducing agents, therefore, carbon cannot reduce their oxides.

(c) NaCl does not conduct electricity in solid state as it does not have free ions to move in solid state but in aqueous solution and in molten states ions are free to move.

(d) Iron articles are galvanised to protect them from rusting.

(e)It is because these metals are highly reactive and occur in the form of their compounds.

31. 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.

Ans. 'A' is sodium as it burns with golden flame in air. 'B' (17) has electronic configuration 2, 7, 7 so 'B' is chlorine.

$2Na + Cl_2 \rightarrow 2NaCl(s)$

'A' 'B' 'C'

$2NaCl(aq) \xrightarrow{\text{electricity}} 2NaOH(aq) + H_2(g) + Cl_2(g)$

'D' Hydrogen gas

32. Two ores A and B were taken. On heating ore A gives CO_2 whereas, ore B gives SO_2. What steps will you take to convert then into metals?

Ans. Ore A gives CO_2, therefore, it is a carbonate ore. Ore 'A' is first subject to calcinations followed by reduction.

$MCO_3 \xrightarrow{\text{Calcination}} MO + CO_2$

$MO + C \xrightarrow{\text{Reduction}} M + CO$

Ore B give SO_2, therefore, it is a sulphide ore. Ore B is first subject to roasting followed by reduction.

$2MS + 3O_2 \xrightarrow{\text{Roasting}} 2MO + 2SO_2$

$MO + C \xrightarrow{\text{Reduction}} M + CO$

(4 mark

Competency Based Questions

I. Read the following passage and answer any 4 questions that follow.

A student took the samples of four metals A,B,C and D and added following solutions one by one. The results obtained have the been tabulated as follows:

Metal	Iron (II) Sulphate	Copper(II) Sulphate	Zinc Sulphate	Silver Nitrate
A	No reaction	Displacement	-	-
B	Displacement	-	No reaction	-
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

1. Choose the most reactive metal:

a. A **b. B** c. C d. D

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

a. A only b. B only c. Both A and B d. None of the above

3. Which is the correct decreasing order of reactivity?

a. B>A>C >D b. A>B>D>C c. D>B>A>C d. B>A>D>C

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

a. Oxygen b. Nitrogen **c. Hydrogen** d. None of the above

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

$A + BX \rightarrow AX + B$

$C + AY \rightarrow CY + A$

a. Most reactive: C; Least reactive ; B

b. Most reactive: B; Least reactive ; C

c. Most reactive: A; Least reactive; B

d. Most reactive: B; Least reactive ; A

II. Read the following passage and answer any 4 questions that follow.

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

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

a. Extraction **b. Refining**

c. Froth floatation d. Electrolysis

2. Which of the metals are refined by electrolytic refining?

(i) Au (ii) Cu (iii) Na (iv) K

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

3. 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.

4. In electrolytic refining of copper, impure copper act as _____ and pure copper as _____:

a. cathode, anode b. cathode, electrolyte

c. anode, cathode d. electrolyte, cathode

5. The anode is _____ and the reaction at the anode is _____

a. negative, oxidation

b. negative reduction

c. positive, oxidation

d. positive, reduction

Case Based Subjective Questions

I. On the basis of reactivity of different metals with oxygen, water and acids as well as displacement reactions, the metals have been arranged in the decreasing order of their reactivities. This arrangement is known as activity series or reactivity series of metals.

The basis of reactivity is the tendency of metals to lose electrons. If a metal can lose electrons easily to form positive ions, it will react readily with other substances. Therefore, it will be a reactive metal. On the other hand, if a meal loses electrons less rapidly to form a positive ions, it will react slowly with other substances.. Therefore, such a metal will be less reactive.

1. **Arrange the following metals in decreasing order of reactivity: Na, K, Cu, Ag.**
2. **X + YSO_4 → XSO_4 + Y and Y + XSO_4 → No Reaction. Out of the two element X and Y which is more reactive and why?**
3. **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.
4. **An iron knife kept in blue copper sulphate solution turns the blue solution into light green. Explain.**

Ans. 1. K>Na >Cu>Ag

2. X is more reactive than Y because it replaces Y from its salt solution.

3. Magnesium, because it is more reactive than zinc.

   $Mg + ZnSO_4 \rightarrow MgSO_4 + Zn$

4. Iron lies above copper in the activity series. This means that iron or iron knife will displace copper from copper sulphate solution. As a result of the reaction, ferrous sulphate will be formed and the solution will be light green in colour.

   $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

   Iron Copper sulphate (blue) Ferrous sulphate (light green) Copper

II. At present, nearly 118 elements are known but all of them do not occur free in nature, some of them have been synthesized by artificial methods. Based on their properties, they are mainly classified as metals and non-metals. Metals are those elements which lose electrons and form positive irons, i.e., they are electropositive in nature. They are generally hard, good conductors of heat and electricity, malleable, ductile and have striking Lustre. They have a significant role to play in our daily life.

1. Name two metals which are found in nature in the free state.
2. Silver and copper lose their shine when they are exposed to air. Name the substance formed on their surface in each case.
3. Write one example each of:
   a. A metal having low melting point and a non-metal having high melting point.
   b. A metal which is a poor conductor of electricity and a non-metal which is a good conductor of electricity.
4. Give reason for the following:
   a. School bells are made up of metals.
   b. Electric wires are made up of copper.

Ans. 1. Gold and silver.

2. These metals get corroded. Silver forms black Ag_2S (silver sulphide) and copper form greenish layer of basic copper carbonate $CuCO_3$. $Cu(OH)_2$
3. (a) Gallium (Ga) is metal with very low melting point (302 K). Diamond (carbon) is a non-metal with very high melting point. (4000K).
   (b) Metal lead (pb) is a poor conductor of electricity whereas graphite (carbon) is a good conductor of electricity.
4. (a) It is because metals are sonorous, i.e., they produce sound when struck with a hard substance.
   (b) It is because copper is good conductor of electricity.