

CHAPTER 3

Metals and Non-Metals

ONE MARK QUESTIONS

1. Give one most suitable word for the following statements:

- Metal oxides which show basic as well as acidic behaviour.
- Iodine, a shining non-metal.

Ans : [CBSE 2015]

- Amphoteric oxides.
- Lustrous.

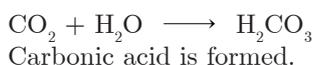
2. Write the chemical equation for the reaction taking place when steam is passed over hot Aluminium?

Ans : [CBSE 2015]



3. What happens when carbon dioxide is compressed in water at high pressure?

Ans : [CBSE 2015]



4. Why oxides of highly reactive metals cannot be reduced by carbon?

Ans : [CBSE 2015]

It is because highly reactive metals themselves are good reducing agents, so they can't be reduced by carbon.

5. Give reason why: Electric wires are coated with plastic.

Ans : [CBSE 2015, 2014]

Plastic is a non-conductor of electricity, therefore electric wires are coated with plastic.

6. Give composition of the alloy: brass and bronze.

Ans : [CBSE 2014]

Brass is made up of Cu and Zn. Bronze is made up of Cu and Sn.

7. What is the formula of rust?

Ans : [CBSE 2014]

Rust is hydrated ferric oxide, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$.

8. An alloy has low melting point and is therefore used for electrical fuse. Name the alloy and write its constituents.

Ans : [CBSE 2014]

Solder is an alloy. It is made up lead and tin.

9. Name one metal and one non-metal in liquid state at

room temperature.

Ans : [CBSE 2013]

Mercury is a metal and Bromine is a non-metal present as a liquid at room temperature.

10. Name two metals which react with dilute HNO_3 to evolve H_2 gas.

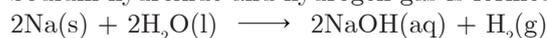
Ans : [CBSE 2013]

Mn and Mg.

11. What is formed when sodium absorb moisture from air? Give equation also.

Ans : [CBSE 2013]

Sodium hydroxide and hydrogen gas is formed:



12. Why sulphide and carbonate ores are converted into oxides?

Ans : [CBSE 2013]

It is because oxides are more easier to be reduced than sulphides and carbonates.

13. From amongst the metal, sodium, calcium, aluminium, copper and magnesium, name the metal:

- which reacts with water only on boiling.
- another one which does not react even with steam.

Ans : [CBSE 2013]

- Mg,
- Cu

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

Ans : [CBSE 2013]

Iron (Fe) :



15. Name the metals Which have low melting point.

Ans : [CBSE 2012, 2011]

Gallium and Caesium.

16. Name a non-metal which is lustrous whereas a metal which is non-lustrous.

Ans : [CBSE 2012, 2011]

Iodine is a lustrous non-metal, Lead is a non-lustrous metal.

17. Choose the amphoteric oxide amongst the following:

Na_2O , ZnO , Al_2O_3 , CO_2 , H_2O

Ans : [CBSE 2012]

ZnO and Al_2O_3 are amphoteric oxides.

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

Ans : [CBSE 2012]

$\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, Basic copper carbonate.

19. Why do ionic compounds have high melting point?

Ans : [CBSE 2012]

It is due to strong forces of attraction between positively charged and negatively charged ions.

20. Define metallurgy.

Ans : [CBSE 2012]

Metallurgy. All the processes involved in the extraction of metals from its ore is called metallurgy.

21. What kind of compounds are called Ionic compounds?

Ans : [CBSE 2012]

Those compounds which are formed between metals and non-metals by transfer of electrons e.g., NaCl , KCl etc.

22. How are ionic compounds formed?

Ans : [CBSE 2012]

Gallium has a melting point 303 K, it melts on palm.

23. Its nature, aluminium is found in combined state whereas silver/gold are found in free state. Give reason.

Ans : [CBSE 2012, 2010, 2011]

Aluminium is reactive metal, therefore it is found in combined state whereas silver/gold are less reactive (noble) metals and so are found in free state.

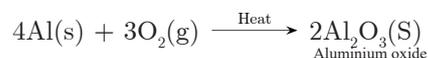
24. Why do ionic compounds conduct electricity in molten state and not in solid state?

Ans : [CBSE 2010, 2012]

Ionic compounds do not conduct electricity in solid state because ions are not free to move. In molten state, ions are free to move.

25. Write a balanced chemical equation for the reaction: Aluminium when heated in air. Write the name of the product formed.

Ans : [CBSE 2012]



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

Ans : [CBSE 2011]

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

27. Why does calcium float in water?

Ans : [CBSE 2011]

Calcium forms hydrogen gas on reaction with water, bubbles of hydrogen gas sticks to the calcium metal and that is why calcium floats in water.



28. Which gas is liberated when a metal reacts with an acid? How will you test this gas?

Ans : [CBSE 2011]

Hydrogen gas is formed.

Bring a burning splinter near the gas, it will burn with 'pop' sound.

29. An element 'A' forms two oxides AO and AO_2 . The oxide AO is neutral whereas the oxide AO_2 is acidic in nature. Would you call element 'A' a metal or a non-metal?

Ans : [CBSE 2011]

The element is carbon which is a non-metal. CO is neutral and CO_2 is acidic in nature.

30. Why do silver ornaments lose their shine when kept in open air for sometime?

Ans : [CBSE 2011]

It is because Ag reacts with H_2S present in the atmosphere to form Ag_2S due to which it loses its shine.

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

Ans : [CBSE 2011]

Copper and aluminium are ductile and good conductors of electricity, therefore they are used in transmission wires.

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

Ans : [CBSE 2011]

It has 4 to 8 valence electrons, it is a non-metal. Exception is hydrogen which has 1 valence electron and He which has 2 valence electrons, but these are non-metals.

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

Ans : [CBSE 2011]

Gold and silver are found in free state.

34. Why do we apply paint on iron grills?

Ans : [CBSE 2011]

Iron grills are painted to prevent them from rusting.

35. Why does stainless steel not get rusted easily?

Ans : [CBSE 2010]

Stainless steel is an alloy of Fe, C, Cr and Ni, therefore it does not get rusted.

36. Why do we use gold and platinum metals in jewellery?

Ans : [CBSE 2010]

Gold and Platinum are lustrous metals and do not react with substances present in the atmosphere, therefore remain lustrous for a long time.

37. Which property makes solder alloy suitable for welding electric wires?

Ans : [CBSE 2010]

Its melting point is low which makes solder suitable for welding.

38. What is the valency of silicon with atomic number 14?

Ans : [CBSE 2010]

Si (2,8,4): Its valency is 4 because it can share four electrons to become stable.

39. What is the valency of phosphorus with atomic number 15?

Ans : [CBSE 2010]

P (2, 8, 5): Its valency is 3 because it can gain three electrons to become stable.

40. What is the valency of an element with atomic number 35?

Ans : [CBSE 2010]

Br(35) (2, 8, 18, 7): Its valency is equal to 1 because it can gain one electron to become stable.

41. Arrange the following metals in decreasing order of reactivity are Na, K, Cu, Ag

Ans : [CBSE 2009]

$K > Na > Cu > Ag$ is the decreasing order of reactivity.

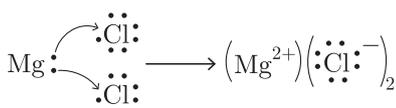
42. Which of the following two metals will melt at body temperature (37°C): Gallium, Magnesium, Caesium, Aluminium?

Ans : [CBSE 2008(C)]

Gallium and Caesium will melt at the body temperature.

43. Show the electronic transfer in formation of MgCl_2 from its elements.

Ans : [CBSE 2008]



c. Which is used to galvanise iron articles?

d. Whose articles when exposed to air forms a black coating?

Ans : [CBSE 2016]

a. Carbon makes it hard and strong. Tungsten also makes it hard and strong.

b. Mercury is alloyed with metals to form amalgam.

c. Zinc metal is used for coating over iron metal to galvanise iron.

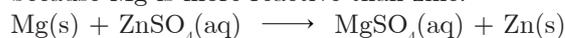
d. Silver articles acquire black coating when left exposed to the atmosphere.

45. Which of the following listed metals can displace zinc from its salt solution? Give reason for your answer with a chemical equation:

Copper, Lead, Magnesium, Silver

Ans : [CBSE 2016]

Magnesium can displace zinc from zinc salt solution because Mg is more reactive than zinc:



46. The reaction of metal X with Fe_2O_3 is highly exothermic and is used to join railway tracks. Identify metal X. Write the chemical equation for the reaction.

Ans : [CBSE 2016]

X is Al.

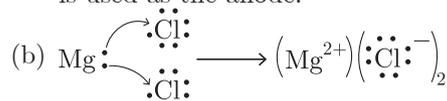


47. (a) In electrolytic refining of impure copper metal, what are used as cathode and anode?

(b) Show the formation of HgCl_2 from magnesium and chlorine atoms.

Ans : [CBSE 2016]

(a) Pure copper is used as the cathode, impure copper is used as the anode.



48. Write one example of each of

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

b. a metal and a non-metal which exist as liquid at room temperature.

Ans : [CBSE 2015]

a. Sodium is so soft that it can be easily cut with a knife.

b. Diamond is the allotrope of carbon, which is the hardest known substance and a non-metal.

c. Mercury is a metal and Bromine is a non-metal which are found in liquid state at room temperature.

49. Mention the name of metals for the following:

a. Two metals which are alloyed with iron to make stainless steel.

b. Two metals which are used to make jewellery.

Ans : [CBSE 2015]

a. Nickel and chromium.

b. Gold and platinum

50. Why is sodium chloride soluble in water but not in

TWO MARKS QUESTIONS

44. Name a metal/non-metal

a. Which makes iron hard and strong?

b. Which is alloyed with other metal to make amalgam?

kerosene?

Ans : [CBSE 2015]

Sodium chloride is the ionic compound and it forms ions in water, therefore it is soluble in water whereas kerosene is a non-polar covalent compound, NaCl does not form ions in kerosene, therefore, it is insoluble in it.

51. a. Why do aluminium sheets not corrode easily?
b. Why is copper vessel corroded with a green coating in rainy season?

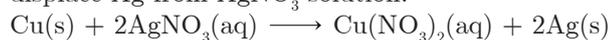
Ans : [CBSE 2015]

- a. Aluminium sheets are covered with an oxide layer which makes it passive.
b. It is due to the formation of basic copper carbonate, $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$.

52. A copper plate was dipped into a solution of silver nitrate. After some time a black layer was observed on the surface of copper plate. State the reason for it and write chemical equation for the reaction involved.

Ans : [CBSE 2015]

Copper is more reactive than Ag, therefore it can displace Ag from AgNO_3 solution:



53. Give reason:

- a. Carbonate and sulphide ores are usually converted into oxides during the process of extraction of metals.
b. Ionic compounds generally have high melting point.
c. Hydrogen is not a metal but has been assigned a place in the reactivity series of metals.
d. The galvanised iron article is protected against rusting even if the zinc layer is broken.

Ans : [CBSE 2015]

- a. It is easier to reduce an oxide than sulphide and carbonate ores.
b. It is due to strong forces of attraction between positive and negative ions.
c. Hydrogen forms H^+ ions like metals, therefore it is included in the activity series.
d. Zinc is more reactive than iron, therefore it will get easily oxidised in preference to Fe and hence protect iron from rusting even if zinc coating is broken.

54. A compound Z is formed by transfer of electrons from the metal X to a non-metal Y, Identify the type of bond formed in the compound. List three properties of compound formed by such type of bonds.

Ans : [CBSE 2014]

The bond formed is ionic bond:

- a. The compound will have high melting and boiling point.
b. It will be soluble in water.
c. It will conduct electricity in molten state as well as in aqueous solution.

55. Give reason for the following:

- a. School bells are made up of metals.

- b. Electrical wires are made up of copper.

Ans : [CBSE 2014,2013]

- a. Metals are sonorous i.e., produce sound when struck with a hard substance.
b. Copper is a good conductor of electricity and is highly ductile.

56. Out of the two metals P and Q, P is less reactive than Q. Suggest an activity to arrange these metals in the order of decreasing reactivity. Support your answer with a suitable chemical equation.

Ans : [CBSE 2014]

Add Q in the salt solution of P. If Q is able to displace P from its salt solution, then it shows P is less reactive than Q



57. Define alloy. How an alloy is prepared?

Ans : [CBSE 2014]

Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also. Alloys are made by melting two metals together and then cooling it.

58. In one of the methods of rust prevention, iron is not coated with anything. Name that method and define it.

Ans : [CBSE 2014]

The method is alloy formation, by adding a suitable metal or a non-metal.

Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also. This process is called alloying.

59. Give reasons for the following:

- a. Platinum, gold and silver are used for making jewellery.
b. Sodium, potassium and lithium are stored under kerosene oil.
c. Aluminium is highly reactive metal but still used for making cooking utensils.
d. Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

Ans : [CBSE 2013, 2014]

- a. It is because they are lustrous metals.
b. These are highly reactive metals.
c. It forms an oxide layer on its surface which makes it passive.
d. It is easier to reduce a metal oxide than sulphides and carbonates.

60. What happens to potassium and sodium if they are kept in open? Why are they kept immersed in kerosene oil?

Ans : [CBSE 2013]

Potassium and Sodium if kept in open, can catch the presence of moisture.

They are immersed in kerosene so that they do not react with air and H_2O present in the atmosphere.

61. Why hydrogen gas is not evolved when a metal reacts

with nitric acid?

Ans : [CBSE 2013]

Nitric acid is an oxidising agent, therefore $H_2(g)$ is not evolved on reaction with metal. Dilute HNO_3 mostly gets reduced to NO in this process.

62. Why is iron galvanised with zinc? Can it be galvanised with copper? If not, why?

Ans : [CBSE 2013]

Iron is galvanised by zinc because zinc is more reactive than Fe. Iron cannot be galvanised by copper because copper is less reactive than iron and therefore iron itself gets corroded when coated with copper.

63. Differentiate between roasting and calcination giving examples.

Ans : [CBSE 2013]

| | Roasting | Calcination |
|----|---|--|
| 1. | It is done in the presence of oxygen. | It is done in the absence of oxygen. |
| 2. | It is done with sulphide ores eg. $2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$ | It is done with carbonate ores e.g. $FeCO_3 \xrightarrow{\text{Heat}} FeO(s) + CO_2(g)$ |

64. Name the ore of mercury. How mercury is extracted from its ore?

Ans : [CBSE 2013]

Cinnabar (HgS) is the ore of mercury.

Roasting:



Cinnabar, on roasting gives Mercury and sulphur dioxide. Mercury can be purified by distillation process.

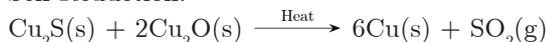
65. How is copper obtained from Cu_2S ? Give reactions.

Ans : [CBSE 2013]

a. Roasting:



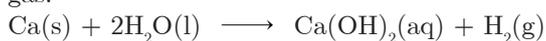
b. Self-Reduction:



66. Explain, why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction.

Ans : [CBSE 2013, 2012]

Calcium reacts with water to form $Ca(OH)_2$ and H_2 gas.



The bubbles of hydrogen gas sticks to the surface of calcium and therefore it floats over water.

67. When a metal X is reacted with cold water, it gives a basic compound Y with molecular formula XOH (Molecular mass 40) and liberates a gas Z which easily catches fire. Identify X, Y, Z.

Ans : [CBSE 2013, 2012]

X is Na (Sodium).



Molecular weight of $NaOH = 40 \text{ g mol}^{-1}$. Y is $NaOH$ and Z is H_2 gas which easily catches fire.

68. Name the following:

- A metal which is preserved in kerosene.
- A lustrous coloured non-metal.
- A metal which melts when kept on palm.
- A metal which is a poor conductor of heat.

Ans : [CBSE 2013, 2012]

- Sodium or Potassium
- Iodine
- Gallium
- Lead

69. Define the term alloy. Write the constituents of Bronze.

Ans : [CBSE 2013]

Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also.

Alloys are made by melting two metals together and then cooling it.

70. Why do silver articles turn black and copper items turn green after sometime?

Ans : [CBSE 2013]

Silver turns black due to the formation of Ag_2S , (Silver sulphide). Copper turns green due to formation of basic copper carbonate.

71. Give reasons for the following:

- Iron grills are frequently painted.
- Gold ornaments retain their lustre even after several years of use.

Ans : [CBSE 2013]

- It is done to prevent them from rusting.
- Gold is least reactive, therefore it remains lustrous even after several years.

72. Give reasons for the following:

- Aluminium oxide is considered as amphoteric oxide.
- Ionic compounds conduct electricity in molten state.

Ans : [CBSE 2012]

- Al_2O_3 reacts with acids as well as bases, therefore it is regarded as amphoteric oxide.
- In molten state, ions are free to move, therefore it conducts electricity.

73. How do properties of iron change when

- a small quantity of carbon is mixed in it?
- nickel and chromium are mixed in it?

Ans : [CBSE 2012]

- It becomes hard and does not get rusted.
- It becomes lustrous and malleable and so it does not get rusted.

74. You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.

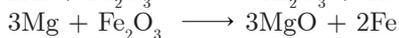
Ans : [CBSE 2012]

Copper vessel coated with a green layer of $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$ which reacts with acid present in lemon or tamarind juice and get removed it. Some substances contain acids which react with basic substances to form soluble salt which can be easily removed.

75. Name two metals which can be used to reduce metal oxides to metals.

Ans : [CBSE 2012]

Aluminium and Magnesium



76. Write four important purposes of making alloys.

Ans : [CBSE 2011]

- It is done to increase the hardness of the substance.
- It is done so as to increase the resistance towards corrosion.
- It helps to modify reactivity.
- It lowers the melting point.

77. State four general properties of ionic compounds.

Ans : [CBSE 2011]

- They are soluble in water.
- They are hard but brittle solids.
- They conduct electricity in solid state and in their aqueous solution.
- They have high melting and boiling points.

78. The way, metals 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.

Ans : [CBSE 2011]

Yes, Na reacts vigorously with cold water because it is highly reactive. Magnesium reacts with hard water because it is less reactive than sodium. Iron reacts only with steam because it is less reactive than Mg:



79. What are amphoteric oxides? Give two examples.

Ans : [CBSE 2011]

Those oxides which react with acids as well as bases are called amphoteric oxides e.g., Al_2O_3 and ZnO .

80. $\text{X} + \text{YSO}_4 \longrightarrow \text{XSO}_4 + \text{Y}$
 $\text{Y} + \text{XSO}_4 \longrightarrow \text{No reaction}$

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

Ans : [CBSE 2011]

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

81. What is an alloy? State the constituents of solder. Which property of solder makes it suitable for welding electrical wires?

Ans : [CBSE 2011]

Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also.

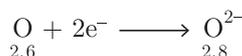
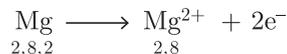
Alloys are made by melting two metals together

and then cooling the mould of two metals being mixed that forms the alloy.

Solder is an alloy of lead and tin. It has low melting point, therefore it is used for welding purposes.

82. Using the electronic configuration, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electrons.

Ans : [CBSE 2011]



83. Write chemical equations that shows aluminium oxide reacts with acid as well base.

Ans : [CBSE 2011]



84. Why is carbon not used for reducing aluminium oxide to obtain Al?

[CBSE 2010]

or

Metals placed high in reactivity series cannot be obtained from their compounds by heating with carbon?

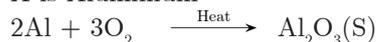
Ans : [CBSE 2011]

It is because Al itself is a strong reducing agent, therefore it cannot be reduced by carbon.

85. 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 of B with HCl and NaOH.

Ans : [CBSE 2011]

A is Aluminium



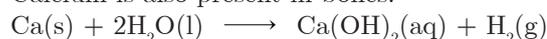
Al_2O_3 is an amphoteric oxide:



86. A substance X which is an oxide of metal is intensively used in cement industry. The element is present in our bones also. On treatment with water, it forms a solution which turns red litmus blue. Identify X and also write the chemical reactions involved.

Ans : [CBSE 2011]

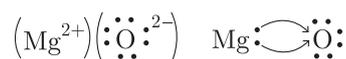
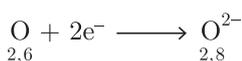
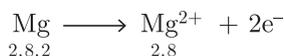
X is calcium. Its oxide, CaO is used in cement industry. Calcium is also present in bones.



Calcium hydroxide turns red litmus blue.

87. 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 the process of formation of their compound by transfer of electrons.

Ans : [CBSE 2010]



88. Write a balanced chemical equation for representing the chemical reaction between manganese dioxide and aluminium powder. What happens if manganese powder is heated with aluminium oxide?

Ans : [CBSE 2010]

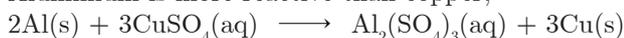


No reaction will take place if manganese powder is heated with Al_2O_3 because Mn is less reactive than Al.

89. If a strip of aluminium with scratched clean surface is dipped into an aqueous solution of copper sulphate for a little time, the surface of the strip becomes brownish. What is the reason for this? Write the balanced chemical equation for this.

Ans : [CBSE 2010]

Aluminium is more reactive than copper,



90. Zinc does not evolve hydrogen gas on reacting with HNO_3 . Why?

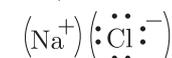
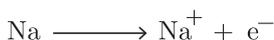
Ans : [CBSE 2010]

Dilute HNO_3 is an oxidising agent, therefore it does not liberate H_2 with zinc. It oxidises N and liberates NO gas (Nitrogen monoxide).

91. Write the electron dot structure for sodium and chlorine atoms. How do these atoms form a chemical bond? Name the type of bond so formed. Why does a compound so formed have high melting point?

Ans : [CBSE Sample Paper 2008-2009]

$\text{Na} \cdot, \cdot \cdot \cdot \cdot \text{Cl} \cdot \cdot \cdot \cdot$ are electron dot structure of Na and chlorine atoms. Sodium can lose an electron and Cl gains that electron and they form an ionic bond.



It has high melting point due to strong forces of attraction between Na^+ and Cl^- ions.

92. Give reason for the following:

- Metals can be given different shapes according to our needs.
- Hydrogen is not evolved when a metal reacts with nitric acid.

Ans : [CBSE 2008(C)]

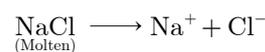
- Metals are malleable, therefore they can be given different shapes.
- It is because $\text{HNO}_3(\text{dil.})$ is a good oxidising agent.

series of metals help in predicting the relative activity of various metals?

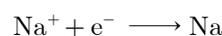
- (b) Suggest different chemical processes used for obtaining a metal from its oxides of metals in the middle of the reactivity series and metals at the top of the reactivity series. Support your answer with one example each.

Ans : [CBSE Sample Paper 2017-2018]

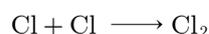
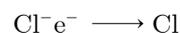
- (a) The series in which metals are arranged in decreasing order of reactivity is called activity series of metals. The metal at the top is most reactive, followed by less reactive metal and so on. The metal at the bottom of activity series is least reactive.
- (b) Metals at the top of activity series are obtained by electrolytic reduction e.g.,



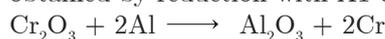
At cathode :



At anode:



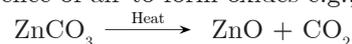
Metals in the middle of the reactivity series are obtained by reduction with Al e.g.,



94. 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 a labelled diagram for the electrolytic refining of copper

Ans : [CBSE 2016]

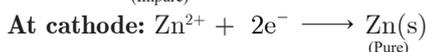
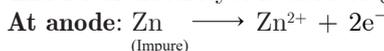
- a. Following steps are involved in the
- Hydraulic washing:** The carbonate ores is washed with stream of water to remove earthly impurities.
 - Calcination:** Carbonate ores is heated strongly in the absence of air to form oxides e.g.,



- Reduction:** ZnO is reduced with carbon to get Zn:



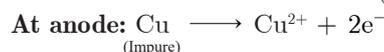
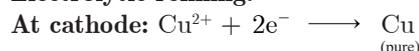
- Electrolytic refining:** Impure zinc is made as anode, pure Zn is taken as cathode, acidified ZnSO_4 of electrolyte is used to get pure metal:



- b. Copper sulphite is concentrated by froth floatation process.

- $2\text{Cu}_2\text{S} + 3\text{O}_2 \longrightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$
- Reduction:** $\text{Cu}_2\text{S} + 2\text{Cu}_2\text{O} \longrightarrow 6\text{Cu} + \text{SO}_2$

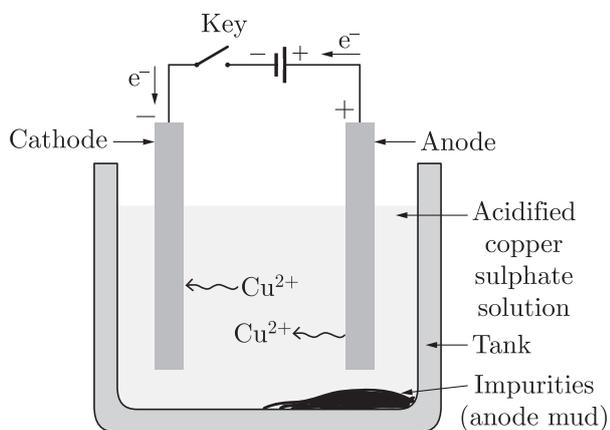
- Electrolytic refining:**



Acidified CuSO_4 is taken as electrolyte.

THREE MARKS QUESTIONS

93. (a) What is reactivity series? How does the reactivity



95. Explain the following statements:

- Most metal oxides are insoluble in water but some of these dissolve in water. What are these oxides and their solution in water called?
- 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.
- Some alkali metals can be cut with knife.

Ans : [CBSE 2016]

- These oxides are basic in nature and their solution are called alkalies.
- The composition of this layer is metal oxide. It prevents the metal from corrosion.
- Sodium can be cut with a knife because it is a very soft metal.

96. Write one example of each of the following:

- Most malleable and most ductile metal.
- The best conductor of heat and poorest conductor of heat.
- 'A metal with highest melting point and a metal with lowest melting point.

Ans : [CBSE 2016]

- Gold is most malleable and ductile.
- Copper is the best conductor and lead is a poor conductor of heat copper.
- Tungsten has highest melting point, mercury has lowest melting point.

97. Aluminium oxide and zinc oxide react with both acids and bases to produce salt and water. What are these oxides called? Write chemical equations in each case.

Ans : [CBSE 2016]

These are called amphoteric oxides:



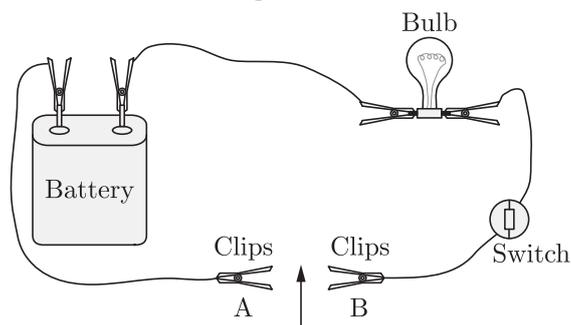
98. Describe an activity to show that metals are good conductors of electricity.

Ans : [CBSE 2016]

Activity: To show metals are good conductors of electricity.

- Take copper wire and insert two clips with a sample to be inserted between them, as shown in the diagram.

- Set up the apparatus as shown in the diagram.
 - Plug the switch ON so that current starts flowing.
 - Record your observations.
 - Repeat the procedure with other metals.
- Observation: The bulb glows with all metals.
Conclusion: Metals are good conductors of electricity.



Insert sample to be tested
Metals are good conductors of electricity

99. a. What is an alloy? How is it prepared? Give two examples of alloys.
b. Iron is not used in pure state. Give reason.

Ans :

- Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also. Alloys are made by melting two metals together and then cooling it. Example: Brass and Bronze
- Iron gets rusted, therefore it is not used in pure state.

100. A metal P when exposed to moist air for a longer period of time, loses its shining brown surface and attains a green coating; what has happened? Identify the metal, write the name and chemical formula of green coloured compound. List two ways to prevent this process.

Ans : [CBSE 2016]

It undergoes corrosion. The metal is copper.

Chemical formula of green coloured compound is $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$

- It can be prevented by coating of tin over iron.
- It can also be prevented by coating it with paint.

101. Name the constituent elements of alloys:

- Brass,
- Bronze,
- Solder.

Mention one use of each alloy.

Ans : [CBSE 2016]

- Brass is made up Cu and Zn. It is used for making decorative articles.
- Bronze is made up of Cu and Sn. It is used for making statues, medals.
- Solder it is an alloy of Pb and Sn. It is used for soldering purposes.

102. Give reasons only:

- We can store copper sulphate solution in a silver vessel but not silver nitrate solution in copper vessel.
- The reaction of zinc with dilute HNO_3 does not produce H_2 gas.

c. Food cans are coated with tin rather than zinc.

Ans : [CBSE 2016]

- It is because copper is more reactive than silver, it will displace Ag from AgNO_3 solution. Thus we can't store AgNO_3 in a copper container but CuSO_4 can be stored in silver vessel as no reaction will take place because silver is less reactive.
- Dilute HNO_3 is an oxidising agent.
- Tin is less reactive and less expensive than zinc.

103. Name a metal in each case:

- It displaces hydrogen gas on reaction with nitric acid.
- It does react with any physical state of water.
- It does not react with cold water or hot water, but reacts with steam.

Ans : [CBSE 2015]

- Mg and Mn
- Cu
- Iron

104. Distinguish between the following:

- Electrolytic reduction and electrolytic refining.
- Mineral and ore.
- Alloys and amalgams

Ans : [CBSE 2015]

| Electrolytic reduction | Electrolytic refining |
|--|---|
| Metal is obtained by electrolysis of molten ore. | Metal is refined by taking impure metal as anode, pure metal as cathode and soluble salt of metal as electrolyte and by passing electric current. |
| Mineral | ore |
| Naturally occurring substances from which metal may or may not be extracted economically e.g., Mica. | Naturally occurring substances from which metal is extracted profitably e.g., Bauxite is an ore of Al. |
| Alloys | amalgams |
| Homogeneous mixture of two or more metals. One of them can be a non-metal also e.g., steel. | Homogenous mixture of mercury with any other metals e.g., zinc amalgam. |

105. State three reasons for the following facts:

- Sulphur is a non-metal.
- Magnesium is a metal.

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

Ans : [CBSE 2015]

- Sulphur is a non-metal because it reacts with O_2 to form SO_2 which is an acidic oxide: $\text{S} + \text{O}_2 \longrightarrow \text{SO}_2$
Magnesium is a metal which reacts with O_2 to form basic oxide:
 $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$
- Sulphur is not malleable and ductile, magnesium

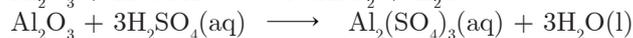
is malleable and ductile.

- Sulphur does not conduct electricity whereas magnesium conducts electricity.

106. A metal forms an oxide having formula M_2O_3 . It dissolves both in dilute sulphuric acid as well as dilute sodium hydroxide solution. Identify the metal and write the equations for the reactions involved.

Ans : [CBSE 2015]

The metal is Al. Its oxide is Al_2O_3 .



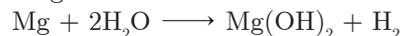
107. State the conditions under which the following metals react with water. Write chemical equation for its reaction with each: (a) Na (b) Mg (c) Fe

Ans : [CBSE 2015]

(a) Sodium metal reacts with cold water as:



(b) Magnesium reacts with hot water as:



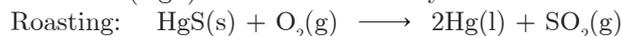
(c) Iron reacts with steam as:



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

Ans : [CBSE 2015]

Cinnabar (HgS) is an ore of mercury.



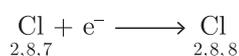
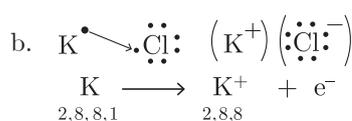
Cinnabar, on roasting gives Mercury and sulphur dioxide. Mercury can be purified by the process of distillation.

109. a Write the electron dot structure of Potassium (19) and Chlorine (17).

- Show the formation of KCl by transfer of electrons.
- Name the ions present in the compound, KCl.

Ans : [CBSE 2015]

a. K^\bullet and $:\ddot{\text{Cl}}:$ are electron dot structures.



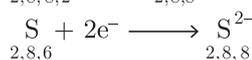
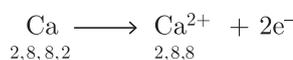
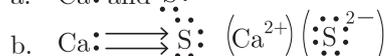
c. K^+ and Cl^- ions are present in KCl.

110. a. Write the electron-dot structure of calcium and sulphur.

- Show the formation of CaS by transfer of electrons.
- Name the ions present in the compound, CaS. Atomic number of Ca = 20, S = 16.

Ans : [CBSE 2015]

a. Ca^\bullet and $:\ddot{\text{S}}:$



c. Ca^{2+} and S^{2-} are present in CaS.

111. Give one most suitable word for the following statements:

- Metal oxides which show basic as well as acidic behaviour.
- Some metals produce a sound on striking with a hard surface.
- Iodine, shining non-metal.

Ans : [CBSE 2015]

- Amphoteric oxide,
- Sonorous,
- Lustrous.

112. State the property utilised in the following:

- Graphite in making electrodes.
- Electric wires are coated with polyvinyl chloride (PVC) or rubber like materials.
- Metal alloys are used for making bells and strings of music instruments.

Ans : [CBSE 2015]

- Graphite is a good conductor of electricity.
- PVC is an insulator, protects us from electric current.
- Alloys are stronger and more sonorous than metals and used for bells and musical instruments. They do not get rusted.

113. Write chemical equations for the reactions taking place when:

- Iron reacts with steam.
- Magnesium (Mg) reacts with dilute HCl.
- Copper is heated in air.

Ans : [CBSE 2014]

- $3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \xrightarrow{\text{Heat}} \text{Fe}_3\text{O}_4\text{(s)} + 4\text{H}_2\text{(g)}$
- $\text{Mg(s)} + 2\text{HCl(dil.)} \longrightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
- $2\text{Cu(s)} + \text{O}_2\text{(g)} \longrightarrow 2\text{CuO(s)}$

114. How metals can be differentiated from non-metals on the basis of any of its three chemical properties?

Ans : [CBSE 2014]

| | Metal | Non-metals |
|----|---|---|
| 1. | Metallic oxides are basic in nature. | Non-metallic oxides are acidic in nature |
| 2. | Most of metals liberate H_2 gas with dilute acids. | Non-metals do not liberate H_2 gas with dilute acids. |
| 3. | Metal hydroxides, bases turn red litmus blue. | Non-metallic oxides form acid in aqueous solution, which turns blue litmus red. |

115. Write chemical equations for the reactions taking place when:

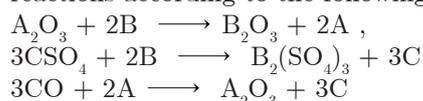
- Iron is strongly heated with air.
- Lead carbonate is calcined.
- Chromium oxide (Cr_2O_3) is heated with aluminium powder.

Ans : [CBSE 2014]

- $3\text{Fe(s)} + 2\text{O}_2\text{(g)} \xrightarrow{\text{Heat}} \text{Fe}_3\text{O}_4\text{(s)}$
- $\text{PbCO}_3\text{(s)} \xrightarrow{\text{Heat}} \text{PbO(s)} + \text{CO}_2\text{(g)}$



116. A, B and C are three elements which undergo chemical reactions according to the following equations:



- Which element is most reactive?
- Which element is the least reactive?
- What type of reactions is listed above?

Ans : [CBSE 2014]

- B is most reactive.
- C is least reactive.
- Displacement reactions.

117. List three properties of sodium in which it differs from general physical properties of most metals.

Ans : [CBSE 2014]

- It is soft.
- It has low melting and boiling point.
- It is not malleable and ductile.

118. Describe ionic compounds on the basis of following properties:

- Strong forces of attraction between positive and negative ions.
- Solubility of compounds in water.
- Electrical conductivity.

Ans : [CBSE 2014]

- They have high melting and boiling points.
- They are soluble in water.
- They conduct electricity in molten state and in aqueous solution.

119. a. Name the metal which does not stick to the glass.
b. Name a metal which is commonly used in thermite welding.
c. What is the nature of Zinc oxide?

Ans : [CBSE 2014]

- Mercury.
- Aluminium displaces molten iron from Fe_2O_3 which is used in thermite reaction for welding purpose.
- It is amphoteric.

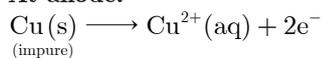
120. a. Define the term 'anode mud'. Name an electrode made of pure metal.
b. Give the reactions taking place at cathode and

anode during the electrolytic refining of copper.

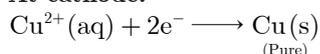
Ans : [CBSE 2014]

a. The impurities left behind at anode after impure copper metal undergoes electrolytic refining is called anode mud.

b. **At anode:**



At cathode:



121. Name two metals which are purified by electrolytic refining. Mention the cathode, anode and electrolyte used in the refining process. At which electrode would the pure metal be deposited?

Ans : [CBSE 2014]

Cu, Zn, Al can be purified by electrolytic refining method:

At cathode, pure metal is deposited. Cathode is made up of pure metal. Anode is made up of impure metal. Soluble salt of metal is used as electrolyte.

122. Write the balanced chemical equation in each case:

- Mg metal is reacted with very, little amount of dilute HNO₃.
- Aluminium powder is added to Fe₂O₃.
- Zinc sulphide is roasted.

Ans : [CBSE 2014]

- $\text{Mg(s)} + 2\text{HNO}_3(\text{S}) \longrightarrow \text{Mg}(\text{NO}_3)_2(\text{aq}) + \text{H}_2$
 $3\text{Mg(s)} + \text{dil.HNO}_3 \longrightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$
- $2\text{Al} + \text{Fe}_2\text{O}_3 \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
- $2\text{ZnS} + 3\text{O}_2 \longrightarrow 2\text{ZnO} + 2\text{SO}_2$

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

- Metal A which is one of the last, second or at the third position in the reactivity series.
- Metal B which gives vigorous reaction even with water and air.
- Metal C which is kept in the middle of the activity series.

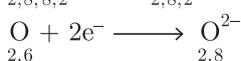
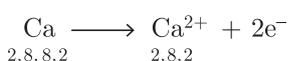
Ans : [CBSE 2013]

- Reduction with carbon.
- Electrolytic reduction.
- Reduction with Al.

124. a. Explain the formation of ionic compound CaO with its electron dot structure. Atomic number of Ca = 20, O = 8.

b. Name the constituents of bronze.

Ans : [CBSE 2012]

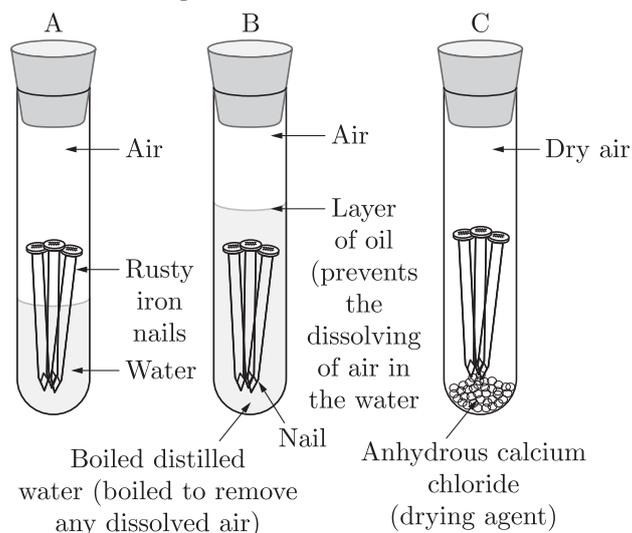


b. Bronze is made up of Copper and Tin.

125. What is meant by rusting? With labelled diagrams, describe an activity to find out the conditions in which rusting takes place.

Ans : [CBSE 2012]

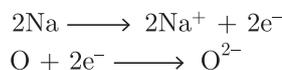
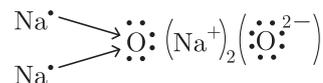
The process in which iron reacts with oxygen in the presence of moisture to form brown layer on its surface is called rusting.



- 126.** a. Show the formation of Na₂O by transfer of electrons between the combining atoms.
- b. Why are ionic compounds usually hard?
- c. How is it that ionic compound in the solid state do not conduct electricity but they do so in the molten state?

Ans : [CBSE 2012]

a.



- b. Ionic compounds are hard due to strong forces of attraction between oppositely charged ions.
- c. In solid state, ions are not free to move but in molten state, ions are free to move.

127. Define the terms: (a) mineral, (b) ore and (c) gangue

Ans : [CBSE 2012]

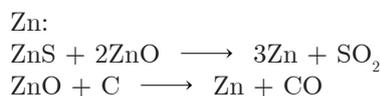
- Mineral: It is a naturally occurring substance from which metal may or may not be extracted economically e.g., Mica.
- Ores: These are naturally occurring substances from which metal can be extracted profitably e.g., Haematite.
- Gangue: The impurities present in the ore is called gangue e.g., SiO₂.

128. 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 the concentrated ore into the related metal.

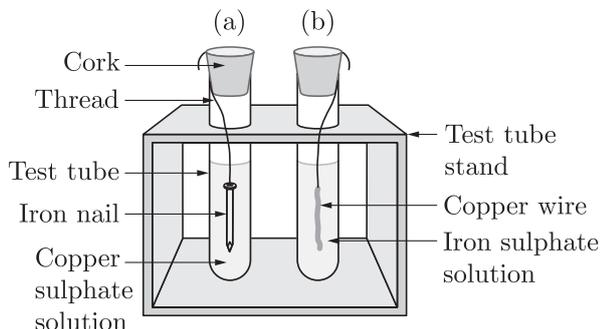
Ans : [CBSE 2009]

It is concentrated by using froth floatation process.

- Roasting: The ore is heated in the presence of oxygen to form oxide e.g.,
 $2\text{ZnS} + 3\text{O}_2 \longrightarrow 2\text{ZnO} + 2\text{SO}_2$
- Reduction: ZnS is reduced by ZnO to get Zn and SO₂. Carbon can also be used to reduce ZnO to



129. Observe the two test tubes A and B as shown in the diagram given below and answer the following questions :



- In which test tube will the reaction take place?
- Write a balanced chemical equation for the reaction.
- Name the type of reaction.

Ans : [CBSE 2008(C)]

- In the first test tube reaction will take place.
- $\text{Fe(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{FeSO}_4(\text{aq}) + \text{Cu(s)}$
- Displacement reaction.

FIVE MARKS QUESTIONS

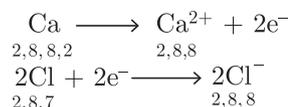
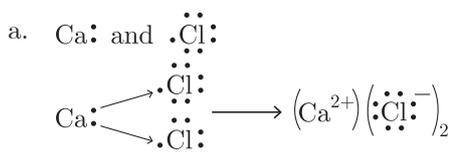
130. a. Define corrosion.
 b. What is corrosion of iron called?
 c. How will you recognise the phenomena of corrosion of silver?
 d. Why corrosion of iron metal is a serious problem?
 e. How can we prevent corrosion of iron?

Ans : [CBSE 2016]

- Corrosion: The process in which a metal react with substances present in atmosphere to form surface compounds is called corrosion.
- Corrosion of iron is called rusting.
- It turns black on corrosion due to the formation of Ag_2S .
- It weakens bridges and materials and a lot of iron gets wasted every year.
- We can prevent corrosion of iron by
 - Painting,
 - Oiling and greasing,
 - Galvanisation,
 - By forming its alloys.

131. a. Write electron dot diagrams of chlorine (At. No. 17) and calcium (At. No. 20). Show the formation of calcium chloride by transfer of electrons.
 b. Identify the nature of the above compound and explain three physical properties of such a compound.

Ans : [CBSE 2015]



- It is an ionic compound.
 - It is soluble in water.
 - It conducts electricity in molten state and in aqueous solution.
 - It is a hard solid.

132. a. What type of ores are calcined? Illustrate with suitable examples.
 b. In what form calcined ore is obtained and how it can be reduced? Give chemical equation for the reduction process involved for the example given by you.
 c. Name any two metals used as reducing agents by displacing metals of low reactivity from their compounds.

Ans : [CBSE 2015]

- Carbonate ores are calcined e.g.,
 $\text{CuCO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{CuO}(\text{s}) + \text{CO}_2(\text{g})$
- It is obtained in oxide form. It is reduced by using a suitable reducing agent e.g.,
 $\text{CuO}(\text{s}) + \text{C} \xrightarrow{\text{Heat}} \text{Cu}(\text{s}) + \text{CO}(\text{g})$
- Al and Mg.

133. a. An ore on treatment with dilute hydrochloric acid produces brisk effervescence. What kind of ore is this? What steps will be required to obtain metal from the enriched ore?
 b. Copper coin is kept immersed in silver nitrate solution for sometime. What change will take place in the coin and in the colour of the solution? Write a balanced chemical equation for the reaction.

Ans : [CBSE 2014]

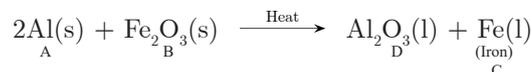
- It is a carbonate ore.
 (i) Hydraulic washing, (ii) Calcination,
 (iii) Reduction, (iv) Refining.
- The solution will become blue in colour, blackish silver metal will get deposited:
 $\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \longrightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$

134. a. Define activity series of metals. Arrange the metals: gold, copper, iron and magnesium in the order of their increasing reactivity.
 b. What will you observe when:
 - Some zinc pieces are placed in copper sulphate solution.
 - Some silver pieces are placed into green coloured ferrous sulphate solution.

Ans : [CBSE 2013]

- The series in which metals are arranged in decreasing order of reactivity is called activity series of metals. The metal at the top is most reactive, followed by less reactive metal and so on. The metal at the bottom is least reactive.
 $\text{Au} < \text{Cu} < \text{Fe} < \text{Mg}$ is the increasing order of reactivity.
- (1) The solution will become colourless, reddish brown copper metal will get deposited:
 $\text{Zn}(\text{s}) + \text{CuSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$

- (2) No reaction will take place because Ag is less reactive than Fe.



This reaction need heat to start but it is highly exothermic.

This reaction belongs to the category of:

- (1) Displacement reaction,
- (2) Redox reaction.

135. A metal (E) is stored under kerosene oil. When a small piece of it is left open in air, it catches fire. When the product formed is dissolved in water, it turns red litmus 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 metal is obtained from its molten chloride.

Ans : [CBSE 2012,2011]

- a. E is sodium metal.
- b. $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$
 H_2 gas will catch fire.
 NaOH turns red litmus blue.
 $4\text{Na}(\text{s}) + \text{O}_2(\text{s}) \longrightarrow 2\text{Na}_2\text{O}(\text{s})$
 $\text{Na}_2\text{O} + \text{H}_2\text{O}(\text{aq}) \longrightarrow 2\text{NaOH}(\text{aq})$
- c. It is obtained by electrolytic reduction e.g., 'Na' metal is obtained by electrolysis of molten NaCl:
 $\underset{\text{Molten}}{\text{NaCl}} \xrightarrow{\text{Electrolysis}} \text{Na}^+ + \text{Cl}^-$
 At cathode: $\text{Na}^+ + e^- \longrightarrow \text{Na}$
 At anode: $\text{Cl}^- \longrightarrow \text{Cl} + e^-$
 $2\text{Cl} + 2\text{Cl} \longrightarrow \text{Cl}_2$

136. a. Write two differences between calcination and roasting. [CBSE 2012]
- b. 'No reaction takes place when granules of a solid 'A' is mixed with a powder of solid 'B'. However when the mixture is heated, a reaction starts with the evolution of much heat. Product 'C' of the reaction settles down as a liquid metal and a solid product 'D' keeps on floating over the liquid 'C'. This reaction is sometimes used for making metals for ready use in odd places.
 - a. Based on this information, make assumptions about metals 'A' and 'B' and corresponding deductions about 'C' and 'D' and write a balanced chemical equation for the reaction. Include in the chemical equation about the physical states of the reactants and products, need for heating for starting the reaction and the reaction being exothermic.
 - b. Name two types of chemical reactions to which this reaction can belong to.

Ans : [CBSE 2012]

- a. Differences between calcination and roasting.

| | Roasting | Calcination |
|----|---|---|
| 1. | It is done in the presence of oxygen. | It is done in the absence of oxygen. |
| 2. | It is done with sulphide ores eg. $2\text{ZnS} + 3\text{O}_2 \longrightarrow 2\text{ZnO} + 2\text{SO}_2$ | It is done with carbonate ores e.g. $\text{FeCO}_3 \xrightarrow{\text{Heat}} \text{FeO}(\text{s}) + \text{CO}_2(\text{g})$ |

- b. A is Al, B is Fe_2O_3 , C is molten Iron, D is Al_2O_3 (Molten)

137. Four metals A, B, C and D are added to the following aqueous solutions one by one. The observations made are tabulated below:

| | Iron (II) sulphate | Copper (II) sulphate | Zinc sulphate | Silver nitrate |
|---|--------------------|-----------------------|---------------|-----------------------|
| A | No Reaction | Reddish Brown Deposit | | |
| B | Grey Deposit | | No Reaction | |
| C | No Reaction | No Reaction | No Reaction | White Shining Deposit |
| D | No Reaction | No Reaction | No Reaction | No Reaction |

Answer the following questions based on the above observations:

- a. Which is the most active metal and why?
- b. What would be observed if B is added to copper (II) sulphate solution and why?
- c. Arrange the metals A, B, C and D in order of increasing reactivity.
- d. Container of which metal can be used to store both zinc sulphate solution as well as silver nitrate solution?
- e. Which of the above solutions can be easily stored in a container made up of any of these metals?

Ans : [CBSE Sample Paper 2009]

- a. B is the most reactive because it displaces Fe. It will displace Fe. It will displace Cu as well as Ag also.
- b. B will displace copper from CuSO_4 solution because it is more reactive than Cu.
- c. D is least reactive and $\text{D} < \text{C} < \text{A} < \text{B}$ is the increasing order of reactivity.
- d. Container of metal D can be used to store both ZnSO_4 and AgNO_3 .
- e. Zinc sulphate solution can be stored in container made up any of the metals A, B, C, D because none of them could displace zinc from zinc sulphate as these are less reactive than zinc.