



## CHEMISTRY

### BOOKS - CHHAYA CHEMISTRY (BENGALI ENGLISH)

## GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

#### Warm Up Exercise

1. Explain why the metals placed above hydrogen in the electrochemical series are not available in nature in the free state.

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2. Gold and platinum exist in free state in nature - why?

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3. What are mineral and ores?



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4. 'All ores are minerals but all minerals are not ores'- explain.



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5. What is gangue?



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6. Copper pyrites ( $Cu_2S \cdot Fe_2S_3$ ) is the ore of which element and why?



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7. Copper and silver are found as sulphide in nature, even though they lie lower position in the electrochemical series.



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8. How can gold or silver be extracted from their ores by Mac Arthur Forest process?



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9. Mention the steps and the reactions involved in the extraction of a metal from its ore.



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10. Mention the process to be adopted for the concentration of sulphide ore, why?



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11. What is the role of sodium ethyl xanthate or pine oil in the froth-floatation method?



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12. What type of ore is concentrated by electromagnetic separation method? Give two examples.



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13. How is alumina separated from bauxite by Bayer's process?



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14. How is PbS separated from ZnS present in the same mineral by froth-floatation method?



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15. Mention the principle of froth-floatation method.



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16. Which type of ore is usually concentrated by hydraulic washing or gravity separation method.



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17. What is the difference between leaching and levigation?



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**18.** What are the two main reduction process employed in the extraction of metals?



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**19.** What do you mean by calcination and roasting?



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**20.** Mention the type of ores involved in calcination and roasting.



**Watch Video Solution**

**21.** During the extraction of copper, why is roasting of copper pyrites carried out instead of calcination?



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**22.** Out of calcination and roasting, which one is carried out in case of the following ores?

Brown haematite

(ii) Bauxite

(iii) Zinc blende

(iv) Calamine



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**23.** During extraction of iron, a basic flux is used, whereas during extraction of copper, an acidic flux is used - why?



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**24.** How is flux selected in the extraction of a metal? Give examples.



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25. Why is flux used during the extraction of iron from haematite, but not during the smelting of roasted zinc blende?



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26. Name the flux that is used for removing each of the following impurities (gangues) from the ore? Why ?

$CaO$



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27. Name the flux that is used for removing each of the following impurities (gangues) from the ore? Why ?

$MgO$



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**28.** Name the flux that is used for removing each of the following impurities (gangues) from the ore? Why?



**Watch Video Solution**

**29.** Name the flux that is used for removing each of the following impurities (gangues) from the ore? Why?



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**30.** What is neutral flux?



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**31.** What is 'thermite welding'? Mention the reducing agent used in this process.



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**32.** What is the role played by flux during extraction of a metal?



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**33.** Roasting converts  $Cu_2S$ ,  $HgS$  or  $PbS$  to the corresponding metal. However, roasting cannot convert  $ZnS$  to  $Zn$  - Why?



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**34.** Which one between  $Ca$  and  $Zn$  can be extracted by electrolytic reduction and which can be extracted by carbon reduction? Explain.



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**35.** Explain why  $\Delta G^\circ$  of oxidation of a metal increases with rise in temperature.



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**36.** What is pyrometallurgy?



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**37.** How can you predict the feasibility of reduction of a metal oxide by another metal with the help of Ellingham diagram?



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**38.** Predict the condition for the reduction of alumina by Mg.



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39. Although thermodynamically feasible, manganese metal cannot be used for the reduction of  $Al_2O_3$  - why?



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40. The  $\Delta_f G^\circ$  for the formation of  $Cr_2O_3$  is  $-540 \text{ kJ.mol}^{-1}$  and that of  $Al_2O_3$  is  $-827 \text{ kJ.mol}^{-1}$ . Is it possible to reduce  $Cr_2O_3$  with aluminium?



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41. The reduction of a metal oxide becomes easy if the metal is obtained in the liquid state at the reduction temperature-why?



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42. Out of C and CO, which one is a better reducing agent at 673K ? Why?



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**43.** Out of C and CO, which one is the reagent of your choice for the reduction of ZnO? Why?



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**44.** State limitations of Ellingham diagram.



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**45.** Although  $H_2$  is a good reducing agent, it is usually not used in metallurgy-why?



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46. Explain why in the Ellingham diagram, the  $(C, CO_2)$  line is nearly horizontal, but the  $(C, CO)$  line slopes downwards.



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47. From the Ellingham diagram, indicate the lowest temperature at which carbon reduces  $ZnO$ .



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48. Explain why is limestone used during manufacture of pig iron from haematite.



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49. The reduction of iron oxide occurs in the blast furnace by C at temperatures above 1073K and by CO at temperature below 1073 K - why?



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50. The hot air blown into the blast furnace must be free from moisture - why?



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51. Explain why is silica added into the Bessemer converter during extraction of copper by self-reduction process.



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52. What is the most widely used process for making steel?



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53. Differentiate between cast iron and pig iron.



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54. Why is the extraction of copper from copper pyrites more difficult than that from its oxide ore through reduction?



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55. What do you mean by poling?



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56. Arrange in the order of increasing carbon content: cast iron, wrought iron, steel.



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57. Predict the temperature for the carbon reduction of  $\text{Cu}_2\text{O}$  from the Ellingham diagram.



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58. Explain why is roasting of zinc blende carried out in controlled supply of air.



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59. Carbon reduction of ZnO is not possible below 1180 K - why?



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60. What are the chief minerals of Zinc?



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61. The reduction of ZnO with coke is carried out at a higher temperature than that of  $Cu_2O$  - explain.



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**62.** What do you mean by blister copper and tough pitch? The percentage of copper is greater in which of them?



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**63.** Explain why the extraction process of copper is called a self-reduction process.



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**64.** What are the steps involved in the extraction of copper from copper pyrites. Name them.



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65. What is called spelter? Mention the role of spiegel is in the production of steel.



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66. What do you mean by electrometallurgy?



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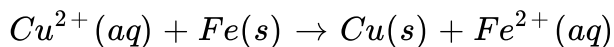
67. How oxidation and reduction take place simultaneously in Mac Arthur Forest process ? Explain your answer with suitable example.



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68. In the following reaction, the difference between  $E^\circ$  values of the two redox couples,  $Cu|Cu^{2+}$  and  $Fe|Fe^{2+}$  is positive. Predict the feasibility

of the reaction.



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**69.** Name the metals that are generally extracted by electrolytic reduction process.



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**70.** What is the role of cryolite and fluorspar in the extraction of aluminium from pure alumina?



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**71.** What is hydrometallurgy? Give an example of extraction of a metal by this process.



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72. Give an example of extraction of a non-metal by oxidation.



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73. What is overvoltage?



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74. Mention the substances used as cathode and anode in the Hall-Heroult process (electrolytic reduction) for the extraction of aluminium.



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75. Explain why in the extraction of Al the surface of the fused matrix is covered with powdered coke.



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**76.** Explain why is aluminium extracted from pure alumina but not directly from bauxite.



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**77.** You have three impure samples of zinc, copper and germanium. Mention the appropriate processes employed for the purification or refining of these metals.



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**78.** Explain why is tin purified by liquation.



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**79.** How can blister copper be converted into pure copper by electrolytic refining?



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**80.** What is anode mud?



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**81.** What are the two main condition of vapour phase refining?



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**82.** What is the principle of zone refining?



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**83.** How can pure Ni be obtained from impure Ni by Mond process?



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**84.** Mention the method of purification of lanthanoids.



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**85.** Name the reducing agent used in thermite welding.



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**86.** Name the alloy of aluminium used for making aeroplanes.



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**87.** Differentiate between brass and bell metal.



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**88.** How do you protect iron from rusting?



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89. What is stainless steel?

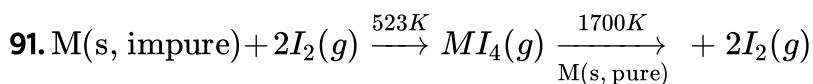


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90. Name the alloy used for making meter scales. Give reason.



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Name the method of purification of the metal and identify the metal M.



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92. What is delta metal?



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**93.** Which copper containing compound is used as an important fungicide for the agricultural purposes?



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**94.** What is galvanisation?



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**95.** Mention the substances used as adsorbents in column chromatography.



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**Question Answer Zone For Board Examination Very Short Answer Type**

1. Give an example of each of the following :

(1) Liquid metal,

(2) Noble metal.



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2. Give example of two metals one of which is available in nature in the free state but another is not.



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3. Arrange the four abundant elements in the order of their decreasing abundance in the earth's crust.



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4. Give an example of each of the following : (a) a light metal



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5. Give an example of each of the following : (b) a heavy metal



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6. Out of haematite ( $Fe_2O_3$ ) and iron pyrites ( $FeS_2$ ), which one is the ore of iron ?



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7. What type of ores are generally roasted ? Why ?



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8. Cu and Ag exist as sulphides though they occupy lower positions in the electrochemical series - why?



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9. Why do some metals occur in the native state?



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10. What type of ores are concentrated by electromagnetic separation?



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11. If the impurities are lighter than the ore, mention the process of the concentration of the ore.



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12. Explain why the concentration of the sulphide ore is usually carried out by froth-floatation.



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13. Name the chief ores of  $Cu$ ,  $Fe$  and  $Al$ . What are the methods employed for the concentration of their ores?



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14. Metal sulphides occur mainly in rocks and metal halides in lakes and seas. Explain.



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15. Write the name of a suitable flux to remove  $SiO_2$  present as gangue.



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16. How are the elements occupying higher positions of the electrochemical series extracted?



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17. Out of C and  $CO$ , which is a better reducing agent for  $FeO$  in the lower region (at higher temperature) of the blast furnace and  $CO$  is a better reducing agent in the upper region (at lower temperature) of the blast furnace.



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18.  $CO$  cannot be used for the reduction of  $ZnO$  – why?



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19. How can the feasibility of reduction of a metal oxide by a metal be predicated from the Ellingham diagram?



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20. Name an alloy of Cu that is used for making utensils.



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21. Name the gas used for the separation of Ni from impurities by Mond process ?



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22. Explain why invar is used for making meter scale.



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23. What is copper matte?



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**24.** Name the anode used in electrolytic refining of Cu?



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**25.** How can a small amount of Cd be removed from zinc?



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**26.** Arrange in the order of increasing carbon content: wrought iron, cast iron and steel.



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**27.** What is the principle of zone refining?



**Watch Video Solution**

**28.** Limestone is used in the preparation of pig iron from haematite - why?



**Watch Video Solution**

**29.** What is pyrometallurgy?



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**30.** Is carbon a satisfactory reducing agent for all metal oxides ? Explain.



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**31.** What do you mean by 'tempering of steel'?



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1. Write down the reactions which occur at the bosch region in blast furnace for the extraction of iron?



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2. Suggest conditions number which, Mg reduces  $SiO_2$  and  $Si$  reduces  $MgO$ ?



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3. At 1273 K, the  $\Delta_f G^\circ$  of  $MgO(s)$  and  $CO(g)$  are  $-941$  and  $-439 \text{ kJ.mol}^{-1}$ . But at 2273 K, the  $\Delta_f G^\circ$  of  $MgO(s)$  and  $CO(g)$  are  $-314$  and  $-628 \text{ kJ.mol}^{-1}$ . On the basis of the given values of  $\Delta_f G^\circ$ , predict the temperature at which carbon is used as a reducing agent for  $MgO(s)$ .



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4. Cinnabar ( $HgS$ ) and galena ( $PbS$ ) on roasting often yield their respective metals but zinc blende ( $ZnS$ ) does not. Explain with reason.



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5. No reducing agent is required in the extraction of copper - explain why.



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6.  $Cu_2O$  is reduced easily by C but  $CaO$  is not - explain.



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7. "The extraction of a metal from its ore is actually the reduction of its compound" - Justify the statement.



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8. Electrolytic reduction is preferred over chemical reaction for the extraction of certain metals - why?



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### Question Answer Zone For Board Examination Additional Question Answer

1. How can pure alumina be prepared from bauxite by Bayers process?

Write the correct reactions.



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2. Write the reactions of

(1) reduction of  $Fe_2O_3$  in blast furnace,



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3. Write the reactions of

(2) extraction of copper from copper pyrites.



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4. State with equations, what happens when (any five) :

(1) A mixture of ferric oxide and Al powder is heated strongly.



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5. State with equations, what happens when (any five) :

(2) Silver is added to an aqueous solution of sodium cyanide and then a current of air is passed through the mixture.



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6. State with equations, what happens when (any five) :

(3) A mixture of  $Al_2O_3$  and concentrated  $NaOH$  solution is heated at

523K under pressure (36 bar).



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7. State with equations, what happens when (any five) :

(4) Dolomite is heated in the absence of air.



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8. State with equations, what happens when (any five) :

(5) Silica is heated with calcium carbonate.



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9. State with equations, what happens when (any five) :

(6) A mixture of cuprous sulphide and cuprous oxide is heated.



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**10.** State with equations, what happens when (any five) :

(7) Al powder is added to copper sulphate solution.



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**11.** State with equations, what happens when (any five) :

(8) Impure nickel is heated in a current of CO at 450-470 K.



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**12.** State with equations, what happens when (any five) :

(9) Impure titanium is heated with  $I_2$  at 523 K and the resulting compound is then heated to a higher temperature (1700 K).



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**13.** State with equations, what happens when :

(10) Al is heated with MgO at temperature- (i) 1623 K and (ii) above 1623 K.



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**14.** Discuss with examples three methods of chemical reduction used in the extraction of metals.



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**Solved Wbchse Scanner**

**1.** For extraction of which one of the given metals, carbon reduction process is not used ? (i) Fe, (ii) Zn, (iii) Al.



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2. Fill in the blanks: Main constituents of dolomite are \_\_\_\_\_ and \_\_\_\_\_.



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3. What is Thermite process? Write one chemical reaction associated with this process.



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4. What are the constituents of aluminium bronze?



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5. Name one ore of zinc.



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6. What is self-reduction process? Give an example of metal extraction in which this process is used.



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7. What is anode mud? What is its economic importance?



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8. Anhydrous  $AlCl_3$  cannot be obtained by heating  $AlCl_3 \cdot 6H_2O$  – why?



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9. Explain why potassium cyanide is used in silver- plating. Give chemical equation.



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10. Write down the composition of electrolytic mixture used in the extraction of aluminium by electrolytic process. Write the chemical reactions occurring at the electrodes in this process.



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11. Write chemical reactions involved in acid Bessemer process in the purification of iron.



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12. Name an acidic flux.



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13. Why is the zinc blende ore roasted before carbon reduction? Answer with balanced chemical equation.



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14. What is malachite? Write down its formula.



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15. Write self-reduction process with balanced chemical reaction in the extraction of copper from copper matte. Why is the process called 'self-reduction'?



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16. Write balanced chemical reaction for the preparation of pure alumina from bauxite by Bayer's process.



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17. Write with the balanced equation how zinc blende is converted to zinc oxide.



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**Solved Cbse Scanner Delhi 2014**

1. What is the role of graphite in the electrometallurgy of aluminium?



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2. Give the principle involved in each of the give processes : (a) Mond process for refining of Ni, (b) Column chromatography for purification of rare elements.



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**Solved Cbse Scanner Outside Delhi 2014**

1. Name the method used for refining of copper metal.



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2. Write the principle behind the froth-floatation process. What is the role of collectors in this process?



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### Solved Cbse Scanner Delhi 2015

1. Outline the principle of refining of metals by the following methods : (i)

Distillation



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2. Outline the principle of refining of metals by the following methods :

(ii) Zone refining



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3. Outline the principle of refining of metals by the following methods :

(iii) Electrolysis



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4. Write down the reactions taking place in different zones in the blast furnace during the extraction of iron. How is pig iron different from cast iron?



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1. What is the role of cryolite in the metallurgy of aluminium?



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2. Differentiate between roasting and calcination.



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3. What is meant by the term 'chromatography'?



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4. Write the reactions taking place in different zone of blast furnace to obtain iron.



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5. Name the method of refining of metals such as germanium.



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6. In the extraction of Al, impure  $Al_2O_3$  is dissolved in conc.  $NaOH$  to form sodium aluminate and leave impurities behind. What is the name of this process?



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7. What is the role of coke in the extraction of iron from its oxide?



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1. Write the principle behind the following :

Vapour phase refining



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2. Write the principle behind the following :

Chromatography



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3. Write the principle behind the following :

Froth-floatation process



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1. Write the principle of used for refining of germanium.



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2. Out of  $PbS$  and  $PbCO_3$  (ores of lead), which one is concentrated by froth-floatation process preferably?



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3. What is the significance of leaching in the extraction of aluminium?



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Solved Cbse Scanner Outside Delhi 2017

1. Write the principle of the following :

Zone refining



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2. Write the principle of the following :

Froth-floatation process



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3. Write the principle of the following :

Chromatography



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4. Write the chemical reactions involved in the process of extraction of gold. Explain the role of dilute  $\text{NaCN}$  and  $\text{Zn}$  in this process.



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1. Which type of ores can be concentrated by magnetic separation method?



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2. What is the significance of leaching in the extraction of aluminium?



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3. Suggest a condition under which magnesium could reduce alumina.



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4. Although thermodynamically feasible, in practice, magnesium metal is not used for the reduction of alumina in the metallurgy of aluminium. Why?



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5. Why is reduction of a metal oxide easier if the metal formed is in liquid state at the reduction temperature?

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6.  $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$ , ( $\Delta G^\circ = -421 \text{ kJ}$ ) is a thermodynamically feasible reaction as is apparent from the Gibbs energy value. Why does it not take place at room temperature?

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7. Is it true that under certain conditions, Mg can reduce  $Al_2O_3$  and Al can reduce  $MgO$ ? What are those conditions?

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8. At a site, low grade copper ores are available and zinc and iron scrap are also available. Which of the two scraps would be more suitable for reducing the leached copper ore and why?



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### Ncert Exercise Questions

1. Copper can be extracted by hydrometallurgy but not zinc. Explain.



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2. What is the role of depressant in froth-floatation process?



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3. Why is the extraction of Cu from pyrites more difficult than that from its oxide ore through reduction?



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4. Explain (i) Zone refining



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5. Explain (ii) Column chromatography.



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6. Out of C and  $CO$ , which is better reducing agent at 673K ?



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7. Name the common elements present in the anode mud in electrolytic refining of copper. Why are they so present?



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8. Write the reactions taking place in different zones in the blast furnace during the extraction of iron.



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9. Write chemical reactions taking place in the extraction of zinc from zinc blende.



**Watch Video Solution**

10. State the role of silica in the metallurgy of copper.



**Watch Video Solution**

11. What is meant by the term, chromatography?



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12. What criterion is followed for the selection of the stationary phase in chromatography?



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13. Describe a method for refining nickel.



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14. How can you separate alumina from silica in a bauxite ore associated with silica? Give equations, if any.



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**15.** Giving examples, differentiate between roasting and calcination.



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**16.** How is cast iron different from pig iron?



**Watch Video Solution**

**17.** Why copper matte is put in silica lined converter?



**Watch Video Solution**

**18.** Differentiate between minerals and ores.



**Watch Video Solution**

19. What is the role of cryolite in the metallurgy of aluminium?



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20. How is leaching carried out in case of low grade  $Cu$  ores ?



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21. Why is zinc not extracted from zinc oxide through reduction using  $CO$  ?



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22. The value of  $(\Delta_f G^\circ)$  for formation of  $Cr_2O_3$  is  $-540\text{kJ}\cdot\text{mol}^{-1}$  and that of  $Al_2O_3$  is  $-827\text{kJ}\cdot\text{mol}^{-1}$ . Is the reduction of  $Cr_2O_3$  possible with  $Al$ ?



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23. Out of C and  $CO$ , which is a better reducing agent for  $ZnO$ ?



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24. The choice of a reducing agent in a particular case depends on thermodynamic factor. How far do you agree with this statement? Support your opinion with two examples.



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25. Name the processes from which chlorine is obtained as a by-product. What will happen if an aqueous solution of  $NaCl$  is subjected to electrolysis?



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**26.** What is the role of graphite rod in the electrometallurgy of aluminium?



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**27.** Outline the principles of refining of metals by the following methods:

(i) Zone refining



**Watch Video Solution**

**28.** Outline the principles of refining of metals by the following methods:

(ii) Electrolytic refining



**Watch Video Solution**

**29.** Outline the principles of refining of metals by the following methods:

(iii) Vapour phase refining.





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30. Predict conditions under which Al might be expected to reduce  $MgO$ .



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### Higher Order Thinking Skill Hots Questions

1. What are the criteria for selecting a good reducing agent to extract metals?



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2. Explain why  $\Delta_f G^\circ$  of a metal oxide increases with rise in temperature.



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3. Why is Zn and not Cu used for the recovery of silver from  $[Ag(CN_2)]^-$  ?



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4. Though  $H_2$  is a good reducing agent why is it not used as a reductant in metallurgy?



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5. Compare between hydrometallurgy & pyrometallurgy.



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6. If galena (PbS) is contaminated with zinc blende (ZnS), how can these be separated by froth-floatation?



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7. A non-spontaneous reaction can be carried out using the concept of coupling reaction. Explain.



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8. The extraction of gold by leaching with NaCN involves both oxidation and reduction. Justify your answer with equations.



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9. What chemical principle is involved in choosing a reducing agent for getting the metal from its oxide ore? Consider the metal oxides  $Al_2O_3$  and  $Fe_2O_3$ , and justify the choice of the reducing agent.



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1. Anhydrous  $FeCl_3$  can be prepared-

- A. by dissolving  $Fe(OH)_3$  in conc.  $HCl$
- B. by dissolving  $Fe(OH)_3$  in dil.  $HCl$
- C. by passing dry  $HCl$  gas through iron turnings
- D. by passing dry  $Cl_2$  gas through iron turning

**Answer: A**



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2. The ore chromite is -

- A.  $FeCr_2O_4$
- B.  $CoCr_2O_3$
- C.  $CrFe_2O_4$
- D.  $FeCr_2O_3$

**Answer: A**



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3. The main advantage(s) of the Lintz-Donawitz (LD) process for the production of steel is (are)-

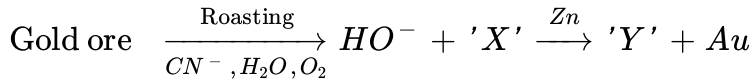
- A. the process is very fast
- B. it is less expensive
- C. the quality of the steel is much higher
- D. scrap steel can be used

**Answer: A::B::C::D**



**Watch Video Solution**

4. Extraction of gold (Au) involves the formation of complex ions 'X' and 'Y'



'X' and 'Y' are respectively-

- A.  $\text{Au}(\text{CN})_2^-$  and  $\text{Zn}(\text{CN})_4^{2-}$
- B.  $\text{Au}(\text{CN})_4^{3-}$  and  $\text{Zn}(\text{CN})_4^{2-}$
- C.  $\text{Au}(\text{CN})_3^-$  and  $(\text{CN})_6^{4-}$
- D.  $\text{Au}(\text{CN})_4^-$  and  $\text{Zn}(\text{CN})_3^-$

**Answer: A**



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5. Roasted copper pyrite on smelting with an produces -

- A.  $\text{FeSiO}_3$  as fusible slag and  $\text{Cu}_2\text{S}$  as matte
- B.  $\text{CaSiO}_3$  as infusible slag and  $\text{Cu}_2\text{O}$  as matte
- C.  $\text{Ca}_3(\text{PO}_4)_2$  as fusible slag and  $\text{Cu}_2\text{S}$  as matte
- D.  $\text{Fe}_3(\text{PO}_4)_2$  as infusible slag and  $\text{Cu}_2\text{S}$  as matte

**Answer: A**



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6. The metal which can be used to obtain metallic Cu from aqueous  $CuSO_4$  solution is -

A.  $Na$

B.  $Ag$

C.  $Hg$

D.  $Fe$

**Answer: D**



**Watch Video Solution**

7. The role of fluorspar, which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite is -

- A. as a catalyst
- B. to make fused mixture conducting
- C. to lower the melting temperature of the mixture
- D. to decreases the rate of oxidation of carbon at anode

**Answer: B::C**



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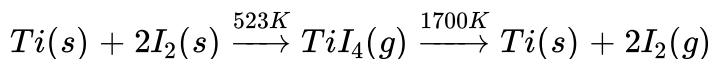
**8.** During electrolysis of molten  $NaCl$ , some water was added. What will happen -

- A. electrolysis will stop
- B. hydrogen will be evolved
- C. some amount of caustic soda will be formed
- D. a fire is likely

**Answer: B::C::D**

Entrance Question Bank Jee Main

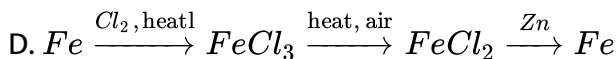
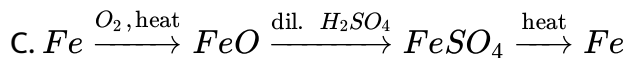
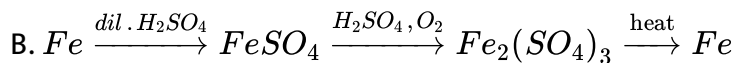
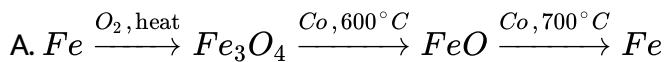
1. Which process of refining can be described by the following equation -



- A. cupulation
- B. polling
- C. van-Arkel method
- D. zone refining

**Answer: C**

2. Which series of reactions correctly represents chemical relations related to iron and its compound -



**Answer: A**



**Watch Video Solution**

**3.** The metal that cannot be obtained by electrolysis of an aqueous solution of its salt is -

A. *Cr*

B. *Ag*

C. *Ca*

D. *Cu*

**Answer: C**

4. In the context of the Hall-Heroult process for the extraction of Al, which of the following statements is false-

- A.  $Al^{3+}$  is reduced at the cathode to form Al
- B.  $NaAlF_6$  serves as the electrolyte
- C.  $CO$  and  $CO_2$  are produced in this process
- D.  $Al_2O_3$  is mixed with  $CaF_2$  which lowers the melting point of the mixture and brings conductivity

Answer: B

5. Which one of the following ores is best concentrated by froth-floatation method -

A. magnetite

B. siderite

C. galena

D. malachite

**Answer: C**



**Watch Video Solution**

**6. Galvanisation is applying a coating of -**

A. *Pb*

B. *Cr*

C. *Cu*

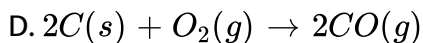
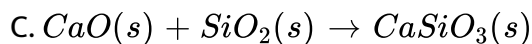
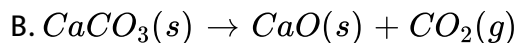
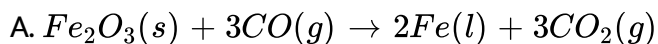
D. *Zn*

**Answer: D**



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7. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag-



**Answer: C**



**Watch Video Solution**

8. Which one of the following pairs of metals is purified by van-Arkel method -

A. Ga and In

B. Zr and Ti

C. Ag and Au

D. Ni and Fe

**Answer: B**



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**9.** Which one of the following elements is present as impurity in pig iron in the largest amount -

A. manganese

B. carbon

C. silicon

D. phosphorus

**Answer: B**



**Watch Video Solution**

10. Which one of the following is an ore of iron -

A. pyrolusite

B. magnetite

C. malachite

D. cassiterite

**Answer: B**



**Watch Video Solution**

11. Which one of the following compounds is used to reduce copper oxide during extraction of copper from sulphide ore -

A. iron sulphide

B. carbon monoxide ( $CO$ )

C. copper (I) sulphide ( $Cu_2S$ )

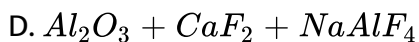
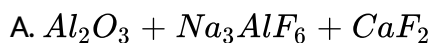
D. sulphur dioxide

**Answer: C**



**Watch Video Solution**

**12.** The molten mixture containing alumina ( $Al_2O_3$ ) from which aluminium is extracted is -



**Answer: A**



**Watch Video Solution**

13. In the extraction of copper from its sulphide ore, the metal finally obtained by the reduction of cuprous oxide with -

- A. iron (II) sulphide
- B. carbon monoxide
- C. copper (I) sulphide
- D. sulphur dioxide

**Answer: C**



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14. Zinc can be coated on iron to produce galvanised iron but the reverse is not possible. It is because -

- A. zinc has higher negative electrode potential than iron zinc is lighter than iron
- B. zinc is lighter than iron

C. zinc has lower melting point than iron

D. zinc has lower negative electrode than iron

**Answer: A**



**Watch Video Solution**

15. Extraction of gold and silver involves leaching with  $CN^{\ominus}$  ion. Silver is later recovered by -

A. distillation

B. zone refining

C. displacement with Zn

D. liquation

**Answer: C**



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16. Considering Ellingham diagram, which of the following metals can be used to reduce alumina -

A.  $Cu$

B.  $Fe$

C.  $Mg$

D.  $Zn$

**Answer: C**



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**Entrance Question Bank Aïims**

1. What is the role of aniline or cresol when added in a froth - floatation process -

A. stabiliser

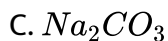
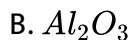
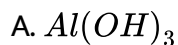
- B. depressant
- C. wetting agent
- D. all of these

**Answer: A**



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2. When  $CO_2$  is passed through solution of sodium meta aluminate, precipitate of which compound is formed -



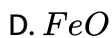
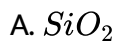
D. no ppt.

**Answer: A**



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3. Slag formed in blast furnace, removes the impurity of -

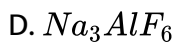
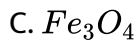
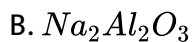
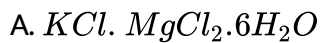


**Answer: A**



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4. The composition of carnallite is -



**Answer: A**



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**5. Which of the following is not the correct match -**

A. leaching : Ag

B. zone refining : Sn

C. liquation : Pb

D. van Arkel : Zr

**Answer: B**



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**6. Oil used as frothing agent in froth - floatation process is -**

A. pine oil

B. mustard oil

C. coconut oil

D. olive oil

**Answer: A**



**Watch Video Solution**

7. Which process is used in smelting during metallurgy of copper -

A. self-reduction of copper

B.  $Cu_2S$  is converted into  $Cu_2O$

C.  $FeS$  is converted into  $FeO$

D. reduction of  $Fe$

**Answer: C**



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8. The first step in the extraction of copper is -

- A. reduction of copper (I) oxide with copper (I) sulphide
- B. reduction with iron
- C. heating ore with coke
- D. roasting of copper (I) sulphide

**Answer: D**



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### Solved Ncert Exemplar Problems

1. In the manufacture of chlorine by electrolysis of brine -

- A.  $Cl^-$  ion is oxidised to yield  $Cl_2$  gas
- B.  $Cl^-$  ion is reduced to yield  $Cl_2$  gas
- C.  $\Delta G^\circ$  of the overall reaction is  $-ve$

D. a displacement reaction occurs

**Answer: A**



**Watch Video Solution**

2. Matte is produced by heating silica with roasted copper ore in a blast furnace. Matte contains -

A. sulphides of copper (II) and iron (II)

B. sulphides of copper (II) and iron (III)

C. sulphides of copper (I) and iron (II)

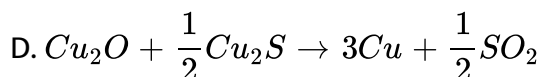
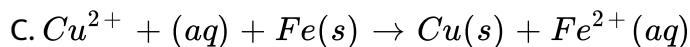
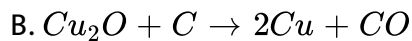
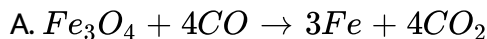
D. sulphides of copper (I) and iron (III)

**Answer: C**



**Watch Video Solution**

3. Which of the following is an example of autoreduction-

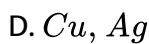
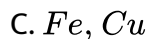
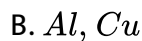
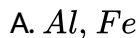


Answer: D



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4. Although many metals are found in the earth's crust, the two most abundant metals are -



**Answer: A**



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5. The basic principle of zone refining is -

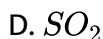
- A. low boiling metallic impurities are separated by distillation
- B. the impurities are more soluble in the molten metal than in the solid metal
- C. the different constituents of a mixture are absorbed differently in an adsorbent
- D. pure metal is obtained by decomposing the vapours of volatile compound obtained from the impure metal

**Answer: B**



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6. Which of the following compounds reduces  $Cu_2O$  to metallic Cu during extraction of Cu from sulphide ore -

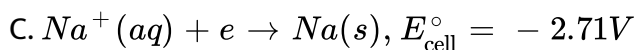
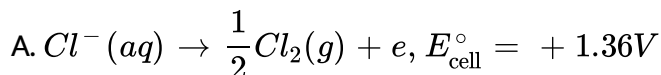


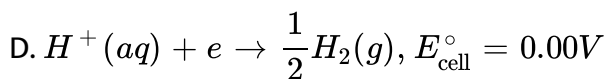
**Answer: C**



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7. The anode reaction taking place in the electrolysis of brine using an inert electrode is -





**Answer: A**



**Watch Video Solution**

**8.** In the metallurgy of aluminium -

- A.  $Al^{3+}$  ion is oxidised to yield  $Al(s)$ .
- B. graphite anode undergoes oxidation to yield  $CO$  &  $CO_2$
- C. anode reaction involves change in oxidation state of O
- D. overall reaction involves change in oxidation state of O

**Answer: B**



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**9.** Electrolytic refining is used to purify -

A.  $Cu \& Zn$

B.  $Ge \& Si$

C.  $Zr \& Ti$

D.  $Zn \& Hg$

**Answer: A**



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**10.** Below the point A,  $FeO$ -

A. can be reduced only by CO

B. can be reduced by both CO and C

C. can be reduced only by C

D. cannot be reduced by either C or CO

**Answer: A**



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11. Select the correct statement in the case of reduction of  $FeO$  at a temperature indicated by the point D-

- A.  $\Delta G$  of the overall reduction reaction involving CO is 0.
- B.  $\Delta G$  of overall reduction reaction involving 1 mole of carbon and 1 mole of oxygen is  $+ve$
- C.  $\Delta G$  of the overall reduction reaction involving 2 moles of carbon and 1 mole of oxygen is  $+ve$
- D.  $\Delta G$  of overall reduction reaction involving CO is  $-ve$ .

**Answer: A**



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12. Extraction of gold and silver involves leaching of the metal with  $CN^-$  ion. The metal is recovered -

- A. by displacing the metal from its complex ion by another metal
- B. by roasting the metal complex
- C. by calcination followed by roasting of metal complex
- D. by thermal decomposition of the metal complex

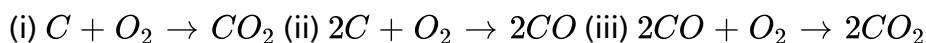
**Answer: A**



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### Solved Ncert Exemplar Problems Multiple Choice Question

1. Temperature range used for the reduction of  $FeO$  by overall effect of the given reactions is related to which points shown in the adjacent graph.



A. point A

B. point B

C. point D

D. point E

**Answer: B::D**



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2. Which of the following statements are correct -

A. cast iron is obtained by melting a mixture of pig iron, scrap iron and coke in a current of hot air

B. in silver extraction, it is extracted as a cationic complex

C. nickel is purified by zone refining

D. Zr and Ti are purified by van-Arkel method

**Answer: A::D**



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3. When  $\text{CaF}_2$  is added to pure  $\text{Al}_2\text{O}_3$  in the extraction of aluminium by Hall and Heroult process -

- A. the melting point of  $\text{Al}_2\text{O}_3$  reduces
- B. conductivity of the molten mixture increases
- C.  $\text{Al}^{3+}$  is reduced to  $\text{Al(s)}$
- D.  $\text{CaF}_2$  acts as a catalyst

**Answer: A::B**



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4. Which of the following statements regarding the role of the substances added in froth-floatation are correct -

- A. the collectors enhance the non-wettability of the mineral particles
- B. the collectors enhance the wettability of gangue particles
- C. sulphides of two metals can be separated by using depressants

D. froth-stabilisers decrease the wettability of gangue

**Answer: A::C::D**



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5. In froth - floatation, ZnS can be separated from PbS by -

A. using collectors

B. maintaining a balance of the ratio of water and oil

C. using depressants

D. using froth - stabilisers

**Answer: B::C**



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6. Bauxite usually contains impurities like -

A.  $CuO$

B.  $ZnO$

C.  $Fe_3O_4$

D.  $SiO_2$

**Answer: C::D**



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7. Ores concentrated by froth-floatation are -

A. haematite

B. galena

C. copper pyrites

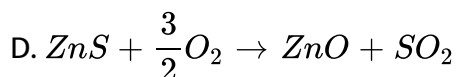
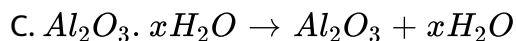
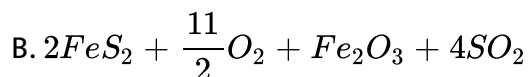
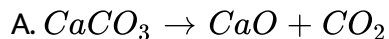
D. magnetite

**Answer: B::C**



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8. Which of the following take place during calcination -



Answer: A::C::D



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9. In metallurgy, which of the following ores are reduced by carbon after calcination -

A. haematite

B. calamine

C. iron pyrites

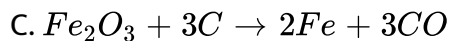
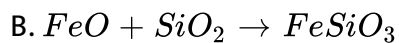
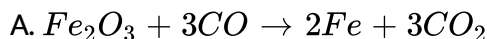
D. sphalerite

Answer: A::B



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10. The reactions involved in the extraction of iron from haematite in the blast furnace are -



Answer: A::C::D



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11. In which of the following purification methods, the metal is first converted into its volatile compound and then it is decomposed to give the pure metal-

A. heating in a current of  $CO$

B. heating with iodine

C. liquation

D. distillation

**Answer: A::B**



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12. Which of the following statements are correct -

A. depressants resist some particles to rise to the surface along with the froth

B. copper matte contains  $Cu_2S$  and  $ZnS$

- C. the metallic copper obtained from the Bessemer converter contains blisters on its surface because the dissolved  $SO_2$  escapes during its solidification
- D. zinc can be extracted by self-reduction

**Answer: A::C**



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**13. During manufacture of chlorine from brine -**

- A.  $\Delta G^\circ$  of the overall reaction is  $-ve$
- B.  $\Delta G^\circ$  of the overall reaction is  $+ve$
- C. the value of  $\Delta E^\circ$  of the overall reaction is  $-ve$
- D. the value of  $\Delta E^\circ$  of the overall reaction is  $+ve$

**Answer: B::C**



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## Solved Ncert Exemplar Problems Short Answer Type

1. An external emf of 2.2 V is required for the manufacture of  $Cl_2$  from brine - why ?



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2. Coke can be used to reduce  $FeO$  to  $Fe$  at temperatures above  $1073K$ . Justify this reduction with the help of an Ellingham diagram.



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3. Wrought iron is the purest form of iron. Write the reactions involved in the preparation of wrought iron from cast iron. How can the impurities like S, Si and P be removed from cast iron?



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4. How can copper be extracted from low grade copper ores?

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5. Mention two primary requirements for the purification of metals by Mond process and van-Arkel process.

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6. Although carbon and hydrogen are good reducing agents, they are not used in the reduction of metal oxides at high temperatures - why ?

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7. Name two sulphide ores which can be separated by froth-floatation.

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8. The purest form of iron is prepared by oxidising the impurities present in cast iron in a reverberatory furnace. What type of iron is used for lining inside the furnace ? Explain with equation.



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9. A mixture of two compounds 'A' and 'B' is allowed to pass through a column filled with  $Al_2O_3$  using alcohol as eluent. Compound 'A' is eluted more easily than compound 'B'. Which out of 'A' and 'B' is strongly adsorbed in the column ?



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10. Copper sulphide ore is heated in a furnace with silica-why?



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**11.** Explain why a sulphide ore is converted into an oxide before reduction.



**Watch Video Solution**

**12.** What is the method used in the purification of Zr and Ti? Explain with equation.



**Watch Video Solution**

**13.** What are the points to be kept in mind during the extraction of metals by electrochemical method?



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**14.** What is the role of flux in extraction of metals?



**Watch Video Solution**

15. How are the metals used as semiconductors purified? Explain the principle of the process.



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16. Write the reaction taking place during the extraction of iron in the blast furnace in the temperature range 500-800K.



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17. Mention two important requirements of vapour phase refining.



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18. Write the equations involved in the extraction of gold by cyanide process. Mention the role of Zn.



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## Solved Ncert Exemplar Problems Matching Type

- | Column - I      | Column - II                  |
|-----------------|------------------------------|
| (A) Pendulum    | (i) Chrome steel             |
| (B) Malachite   | (ii) Nickel steel            |
| 1. (C) Calamine | (iii) $Na_3AlF_6$            |
| (D) Cryolite    | (iv) $CuCO_3 \cdot Cu(OH)_2$ |
|                 | (v) $ZnCO_3$                 |



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2.

- | Column - I                              | Column - II                  |
|---|------------------------------|
| (A) Coloured bands                      | (i) Zone refining            |
| (B) Volatile compound from impure metal | (ii) Fractional distillation |
| (C) Purification of Ge and Si           | (iii) Mond process           |
| (D) Purification of Hg                  | (iv) Chromatography          |
|   | (v) Liquation                |



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Column - I

(A) Cyanide process

(B) Froth-floatation

3. (C) Electrolytic reduction

(D) Zone refining

Column - II

(i) Ultrapure Ge

(ii) Dressing of ZnS

(iii) Al extraction

(iv) Au extraction

(v) Purification of Ni



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Column - I

(A) Sapphire

(B) Spharelite

4. (C) Depressant

(D) Corundum

Column - II

(i)  $Al_2O_3$

(ii)  $NaCN$

(iii) CO

(iv)  $ZnS$

(v)  $Fe_2O_3$



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Column - I

(A) Blister copper

(B) Blast furnace

5. (C) Reverberatory furnace

(D) Hall-Heroult process

Column - II

(i) Aluminium

(ii)  $2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

(iii) Iron

(iv)  $FeO + SiO_2 \rightarrow FeSiO_3$

(v)  $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$



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6. Assertion (A) : Zr can be purified by van Arkel method.

Reason (R) :  $ZrI_4$  is volatile and dissociates at 1800 K.

A. (A) and (R) both are correct statements and (R) is correct explanation of (A).

B. (A) and (R) both are correct statements but (R) is not correct explanation of (A).

C. (A) is correct statement but (R) is wrong statement.

D. (A) and (R) both are incorrect statements.

**Answer: A**



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7. Assertion (A) : Sulphide ores are concentrated by froth-floatation.

Reason (R) : In froth-floatation, cresol stabilises the froth formed.

A. (A) and (R) both are correct statements and (R) is correct explanation of (A).

B. (A) and (R) both are correct statements but (R) is not correct explanation of (A).

C. (A) is correct statement but (R) is wrong statement.

D. (A) and (R) both are incorrect statements.

**Answer: B**



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8. Assertion (A) : Zone refining is very useful for the preparation of semiconductors.

Reason (R) : A semiconductor is a very pure substance.

A. (A) and (R) both are correct statements and (R) is correct explanation of (A).

B. (A) and (R) both are correct statements but (R) is not correct explanation of (A).

C. (A) is correct statement but (R) is wrong statement.

D. (A) and (R) both are incorrect statements.

**Answer: D**



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**9. Assertion (A) :** In hydrometallurgy, the ore is first dissolved in a suitable reagent and then it is precipitated by displacing the metal by a more electropositive one.

**Reason (R) :** Copper is extracted by hydrometallurgy.

A. (A) and (R) both are correct statements and (R) is correct explanation of (A).

B. (A) and (R) both are correct statements but (R) is not correct explanation of (A).

C. (A) is correct statement but (R) is wrong statement.

D. (A) and (R) both are incorrect statements.

**Answer: B**



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### Solved Ncert Exemplar Problems Assertion Reason Type

1. Assertion (A) : Nickel can be purified by Mond process.

Reason (R) :  $Ni(CO)_4$  is a volatile compound and it dissociates at 460K to yield pure nickel.

A. (A) and (R) both are correct statements and (R) is correct explanation of (A).

B. (A) and (R) both are correct statements but (R) is not correct explanation of (A).

C. (A) is correct statement but (R) is wrong statement.

D. (A) and (R) both are incorrect statements.

**Answer: A**



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### Solved Ncert Exemplar Problems Long Answer Type

1. Explain -  $CO_2$  is a better reducing agent below 710 K whereas  $CO$  is a better reducing agent above 710 K.



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2. Explain - Sulphide ores are generally converted into oxides before reduction.



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3. Explain - In reverberatory furnace, silica is mixed with the sulphide ore of copper.



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4. Explain - Carbon and hydrogen are usually not used as reducing agents at higher temperature.



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5. Explain - Vapour phase refining is used for purification of Ti.



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**Mcq Single Correct Type**

1. The metals that settle down as 'anode - mud' are -

A. Fe, Ni

B. Ag, Au

C. Pb, Zn

D. Se, Ag

**Answer: B**



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**2. The metal that is purified through polling is -**

A. sodium

B. blister copper

C. zinc

D. silver

**Answer: B**



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3. The process of removing impurities caused by sulphur, by heating the ore in presence of air is known as -

- A. roasting
- B. calcination
- C. smelting
- D. leaching

**Answer: A**



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4. In the manufacture of steel, the process in which  $O_2$  is used instead of air is -

- A. open-hearth process
- B. acidic Bessemer's process

C. alkaline Bessemer's process

D. LD process

**Answer: D**



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5. Thomas slag is -

A.  $MnSiO_3$

B.  $CaSiO_3$

C.  $Ca_3(PO_4)_2 \cdot CaO$

D.  $Ca_3(PO_4)_2$

**Answer: C**



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6. The ore containing two metals is -

- A. haematite
- B. galena
- C. copper pyrites
- D. megnetite

**Answer: C**



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7. The reaction in the final state of extraction of copper from copper pyrites using Bessemer's process -

- A.  $Cu_2S + O_2 \rightarrow 2Cu + SO_2$
- B.  $4Cu_2O + FeS \rightarrow 8Cu + FeSO_4$
- C.  $2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$
- D.  $Cu_2S + 2FeO \rightarrow 2CuO + 2Fe + SO_2$

**Answer: C**



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**8. Ellingham diagram can be drawn in case of -**

A. sulphide

B. oxide

C. halide

D. all

**Answer: D**



**Watch Video Solution**

**9. If silica is present as impurity, the flux that is used is -**

A. CaO

B.  $MgCO_3$

C.  $CaCO_3$

D. all

**Answer: D**



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**10.** The mineral which contains both Mg and Ca is -

A. dolomite

B. gypsum

C. epsomite

D. talc

**Answer: A**



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11. In froth-floatation, anilline or cresol acts as a -

- A. stabiliser
- B. depressant
- C. hydrolyser
- D. all of these

**Answer: A**



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12. In zone refining, the molten zone contains -

- A. only impurities
- B. more impurities than the metal
- C. only pure metal
- D. less impurities than the metal

**Answer: B**



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**13.** A reducing agent is not required in the separation of -

- A. iron from haematite
- B. aluminium from bauxite
- C. mercury from cinnabar
- D. zinc from zinc blende

**Answer: C**



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**14.** The process that is not applicable in extraction of Al -

- A. van-Arkel

B. Serpeck

C. Bayer

D. Hall-Heroult

**Answer: A**



**Watch Video Solution**

**15. In aluminothermic process, aluminium acts as -**

A. oxidising agent

B. flux

C. reducing agent

D. solidifier

**Answer: C**



**Watch Video Solution**

**16.** The salt that is rare in minerals -

- A. chloride
- B. sulphate
- C. sulphide
- D. nitrate

**Answer: D**



**Watch Video Solution**

**17.** The constituents of magnalium are -

- A. Mg, Al
- B. Fe, Mg
- C. Ni, Zn
- D. Al, Zn

**Answer: A**



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**18.** Cassiterite is concentrated by the process of -

- A. levigation
- B. magnetic separation
- C. froth-floatation
- D. liquation

**Answer: B**



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**19.** The ore that can be best concentrated by froth - floatation -

- A. magnetite

B. malachite

C. galena

D. cassiterite

**Answer: C**



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**20.** The ore that does not contain aluminium is -

A. fluorspar

B. feldspar

C. cryolite

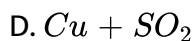
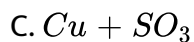
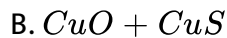
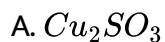
D. mica

**Answer: A**



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21. Heating a mixture of  $Cu_2O$  and  $Cu_2S$  gives -

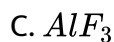
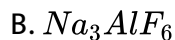


**Answer: D**



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22. In the Hall-Heroult's process, the principal reagent is mixed with -



D. none

**Answer: B**



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**23.** In the extraction of iron,  $Fe_2O_3$  is reduced with -

- A. carbon dioxide
- B. aluminium
- C. carbon and carbon monoxide
- D. electrolytic reduction

**Answer: C**



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**24.** The metal - pair that does not form an alloy -

- A.  $Zn, Cu$

B.  $Hg, Na$

C.  $Fe, C$

D.  $Fe, Hg$

**Answer: D**



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25. During the preparation of blister copper, blisters are formed on the surface of copper due to evolution of -

A.  $N_2$

B.  $CO$

C.  $CO_2$

D.  $SO_2$

**Answer: D**



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26. Pick out the correct statement -

- A. Mn salts form violet borax beads in the reducing flame.
- B. from a mixture of AgCl and AgI precipitates,  $NH_3$  dissolves AgCl only
- C. in the presence of potassium ferrocyanide solution, ferric ion gives a deep green precipitate
- D. on boiling a solution of  $K^+$ ,  $Ca^{2+}$  and  $HCO_3^-$  ions,  $K_2Ca(CO_3)_2$  is precipitated

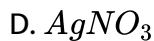
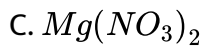
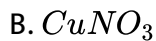
Answer: B



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27. A metal is left behind on strongly heating -

- A.  $Fe(NO_3)_3$



**Answer: D**



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**28. Lapis lazulli is -**

A. ferrous sulphate

B. copper sulphate

C. sodium alumino silicate

D. zinc sulphate

**Answer: C**



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29. The process of purification of silicon is -

- A. zone refining
- B. thermal decomposition
- C. froth-floatation
- D. vapour phase refining

**Answer: A**



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30. The reducing agent in the process of self-reduction is -

- A.  $S$
- B.  $O^{2-}$
- C.  $S^{2-}$
- D.  $SO_2$

**Answer: C**



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**31.** Which of the following methods are related to the concentration or beneficiation of the ore -

- A. gravity separation
- B. froth-floatation
- C. electromagnetic separation
- D. liquation

**Answer: A::B::C**



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**32.** Which of the following statements related to the metallurgy of iron are correct -

A. coke reduces  $FeO$  to  $Fe$  at temperatures above 1073K

B. CO reduces  $Fe_2O_3$  to FeO below 1073 K

C. coke reduces  $FeO$  to Fe at temperature below 1073 K

D. CO reduces  $Fe_2O_3$  to Fe at temperature above 1073 K

**Answer: A::B**



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**33.** Which of the following oxides cannot be reduced by carbon to the corresponding metal-

A.  $ZnO$

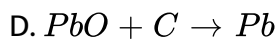
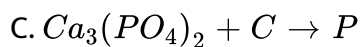
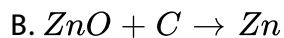
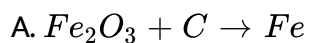
B.  $Al_2O_3$

C.  $CuO$

D.  $MgO$

**Answer: B::D**

34. Which of the given reduction processes are correct -



Answer: A::B::C::D

35. Roasting is carried out -

A. to convert sulphide ore to respective oxide and sulphate

B. to remove the hydrated molecules

C. to melt the ore

D. to remove arsenic and sulphur impurities

**Answer: A::C::D**



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### Exercise Very Short Answer Type Questions

1. Give one example each of a collector and a froth stabiliser used in froth-floatation.



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2. What do you mean by 'seeding' in Bayer's process ?



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3. What is thermite welding?



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4. Write the composition of charge used in the extraction of iron.



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5. Name the ore of aluminium that is generally used for its extraction.



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6. What are 'tough pitch' and 'spelter'?



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7. Name two metals which are available in the free state in nature.



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8. Give an example of a mineral which is not an ore.



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9. What is white bauxite and red bauxite?



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10. Name the metals that are usually extracted by electrolytic reduction.

Give reason. Mention their positions in the periodic table.



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11. Name the reducing agent that is used in the thermite process?



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12. Why does roasting of cinnabar  $\text{HgS}$ , produce the metal, mercury, rather than an oxide of mercury?



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13. Name the method of purification that produces metals of very high purity?



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14. Name the method used to obtain pure copper from blister copper?



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15. What is '18-8' steel?



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16. How is carbon found to be present in wrought iron?



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17. What is cupellation?



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18. Name two sulphide ores which can be separated by froth-floatation.



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19. Give an example each of an acidic and a basic flux.



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20. How can a small amount of cadmium be removed from zinc?



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21. Name two metals which are purified by liquation.



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22. Which of the following ores cannot be concentrated by electromagnetic separation?

Chromite ( $FeCr_2O_4$ ), magnetite ( $Fe_3O_4$ ), zinc blende ( $ZnS$ ), pyrolusite ( $MnO_2$ ).



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23. What are the constituents of copper matte?



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24. Name two metals which are purified by chromatography.



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25. What happens when the sulphide ore of mercury is subjected to roasting?



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26. Name the alloy of aluminium that is used for making aeroplanes.



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27. Name the method used for purifying metals like zirconium and titanium?



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**28.** Name the alloy used in making ball bearings.



**Watch Video Solution**

**29.** Explain why metals do not exist as nitrate salt in nature.



**Watch Video Solution**

**30.** Explain why metals do not exist as nitrate salt in nature.



**Watch Video Solution**

**31.** Name the method used in refining of aluminium.



**Watch Video Solution**

**32.** What is smelting?



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33. What is thermite mixture?



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### Exercise Fill In The Blanks

1. All minerals are not \_\_\_\_\_.



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2. Highly reactive metals are found to occur in nature in the \_\_\_\_\_ state.



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3. The most abundant metal in the earth's crust is \_\_\_\_\_.



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4. Calcination is important for \_\_\_\_\_ ores.



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5. Neutral slag reduces the \_\_\_\_\_ of the ore.



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6. The ore of tin containing  $FeCrO_4$  is concentrated by \_\_\_\_\_.



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7. Name the reducing agent that is used in the thermite process?



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8. \_\_\_\_\_ is used as a flux to remove  $SiO_2$  (gangue).



Watch Video Solution

9. The most pure iron is \_\_\_\_\_ .



Watch Video Solution

10. The highly electropositive metals like  $Na$ ,  $Mg$  or  $Al$  are extracted by \_\_\_\_\_.



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11. \_\_\_\_\_ electrode is used as anode in the electrolysis of  $Al_2O_3$ .



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12. Low melting metals like lead and tin are purified by \_\_\_\_\_.



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13. \_\_\_\_\_ is used in purification of nickel by Mond process.



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14. The slag obtained from blast furnace mainly contains \_\_\_\_\_.



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15. Mg reduces  $Al_2O_3$  below \_\_\_\_\_.



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16. Metals of very high purity are produced by method.



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17. The metals used in space technology are purified by \_\_\_\_\_ method.



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18. Froth-floatation is used for concenrating \_\_\_\_\_ ores.



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19. \_\_\_\_\_ solution is used for the extraction of silver and gold from their ores.



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20. In the extraction of iron, \_\_\_\_\_ acts as a reducing agent in the upper region of the blast furnace and \_\_\_\_\_ acts as a reducing agent in the

lower region of the blast furnace.



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21. In the Ellingham diagram, since the  $(Cr, Cr_2, O_3)$  line lies \_\_\_\_\_ the  $(Al, Al_2O_3)$  line, therefore, aluminium reduces  $Cr_2O_3$ .



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22. The alloy steel used for making permanent magnet is \_\_\_\_\_ .



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23.  $Al_2O_3$  is used in \_\_\_\_ chromatography.



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24. The reduction of a metal oxide is easier if the metal is formed in the \_\_\_\_\_ state at the temperature of reduction.



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25. To protect various articles of iron from rusting, they are coated with \_\_\_\_\_ by the process of \_\_\_\_\_.



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### Exercise Short Answer Type Questions

1. All ores are minerals, but all minerals are not ores- explain with examples.



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2. What are the basic requirements of vapour phase refining?



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3. Give a flow diagram for Mac Arthur Forrest process for the separation of silver or gold.



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4. What type of impurities are removed by calcination ? How ?



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5. Name two metals which can be extracted by self-reduction. How does the reduction of metal compound take place in this process?



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6. Write the principle of basic oxygen process (BOP) in preparing steel.



**Watch Video Solution**

7. What is froth-floatation? Write its principle.



**Watch Video Solution**

8. What is leaching? Explain with an example.



**Watch Video Solution**

9. What do you mean by concentration or beneficiation of ores?



**Watch Video Solution**

10. Comment on the occurrence of metals like Na, Fe and Au in nature.



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11. What type of ore is usually concentrated by electromagnetic separation method? Give two examples.



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12. Mention the methods briefly used in the beneficiation of the following ores :

(a) Haematite



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13. Mention the methods briefly used in the beneficiation of the following ores :

(b) Cassiterite



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**14.** Mention the methods briefly used in the beneficiation of the following ores :

(c) Chromite



**Watch Video Solution**

**15.** Mention the methods briefly used in the beneficiation of the following ores :

(d) Copper pyrites



**Watch Video Solution**

**16.** What is flux? How is it chosen in metallurgy?



**Watch Video Solution**

**17.** Is carbon a suitable reducing agent for all metal oxides? Give reason.



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18. Differentiate between hydrometallurgy and electrometallurgy with suitable examples.



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19. Is it possible to extract aluminium by electrolytic reduction of  $Al_2O_3$  ? Explain with reasons.



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20. Is it possible to extract Al by the electrolysis of an aqueous solution of aluminium sulphate? Explain.



Watch Video Solution

21. Copper is obtained by roasting its sulphide ore - explain.



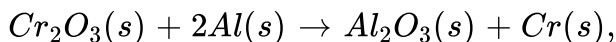
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22. Discuss the thermodynamic principles of metallurgy.



Watch Video Solution

23. Explain why the following reaction, although thermodynamically feasible, does not take place at ordinary temperature.



$$\Delta G^\circ = -421 kJ$$



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24. Discuss the limitations of Ellingham diagram.



Watch Video Solution

25. Name the precious metals in anode mud? Unlike copper, these metals do not enter into the solution - why?



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26. The ( $C$ ,  $CO$ ) line on the Ellingham diagram slopes downwards. Give reason.



Watch Video Solution

27. The ( $Co$ ,  $CO_2$ ) line on the Ellingham diagram slopes upwards. Give reason.



Watch Video Solution

**28.** Write the reactions taking place in different zones in the blast furnace during extraction of iron.



**Watch Video Solution**

**29.** In metallurgy, the sulphide ore of copper is partly roasted. Why?



**Watch Video Solution**

**30.** How can  $\text{ZnS}$  be separated from a mixture of  $\text{PbS}$  and  $\text{ZnS}$ ?



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**31.** Mention an important use of the thermite process.



**Watch Video Solution**

32. What is the difference between carbon reduction and electrolytic reduction?



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33. Aluminium reduces  $Cr_2O_3$  to  $Cr$ , but chromium cannot reduce  $Al_2O_3$  to  $Al$  – why?



Watch Video Solution

34. What is vapour phase refining ? Explain with an example.



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35. Give an example of extraction of a metal both by oxidation and reduction.



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**36.** CO is a more effective reducing agent than C (coke) below 983K, but C is a more effective reducing agent than CO above 983K- explain with reasons.



**Watch Video Solution**

**37.** Although Cu and Ag are placed below hydrogen in the electrochemical series, they exist in nature as sulphides - explain.



**Watch Video Solution**

**38.** Name the metals that are usually extracted by electrolytic reduction. Give reason. Mention their positions in the periodic table.



**Watch Video Solution**

**39.** Though  $H_2$  is a good reducing agent, why is it not used as a reductant in metallurgy?



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**40.** Why is the temperature during carbon-reduction of  $ZnO$  maintained at  $1400^\circ C$ , though the boiling point of zinc is  $920^\circ C$ .



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**41.** Cinnabar ( $HgS$ ) and galena ( $PbS$ ) are converted into their respective metals on roasting but zinc blende ( $ZnS$ ) does not. Explain with reason.



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**Additional Question Mention The Role Of**

1. Cryolite in the metallurgy of aluminium.



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2. Iodine in refining of titanium.



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3. NaCN in the extraction of silver from silver ore.



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4. CO in purifying nickel.



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5.  $\text{SiO}_2$  in the extraction of copper from copper matte.



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6. Depressant in concentration by froth-floatation.



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7. Carbon anode in the electrolytic reduction of  $Al_2O_3$ .



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8. Collectors in froth-floatation.



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**Additional Question State With Equations What Happens When**

1. Zinc is added to a solution of potassium dicyanoaurate (I)



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2.  $Cu_2S$  is subjected to partial roasting



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3.  $Mn_3O_4$  is heated with aluminium powder



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4. Electrolysis of a molten mixture of  $Al_2O_3$ , cryolite and fluorspar is carried out



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5. Zinc rod is immersed in a solution of copper sulphate



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6. Ferric oxide is heated with phosphorus pentoxide



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7. Malachite is heated



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8. Concentrated NaOH solution is added to alumina and the mixture is heated at 523 K



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9. Current of air is passed through a dilute solution of KCN containing gold



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10. Electrolysis of brine is carried out



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11.  $H_2$  gas is passed through  $CuSO_4$  solution



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12.  $ZrI_4$  is heated over a tungsten filament at 2075K



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### Additional Question Distinguish Between

1. Mineral and ore



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## 2. Calcination and roasting



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## 3. Flux and gangue



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## 4. Pyrometallurgy and hydrometallurgy



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## 5. Cast iron and wrought iron



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## 6. Zone refining and vapour phase refining



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## 7. Bell metal and brass



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## 8. Invar and alnico



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## 9. Wrought iron and steel



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## 10. Magnalium and duralumin



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## Additional Question Mention The Principles Of The Following Processes

### 1. Froth-floatation



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### 2. Electrolytic refining



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### 3. Zone refining



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### 4. Vapour phase refining



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## 5. Chromatography



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## 6. Electromagnetic separation



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## 7. Leaching or chemical separation



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## 8. Reduction of a metal oxide by a metal



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## Additional Question Write The Reactions Involved In

1. Extraction of iron from haemattite in blast furnace



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2. Extraction of aluminium from bauxite



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3. Extraction of zinc from zinc blende



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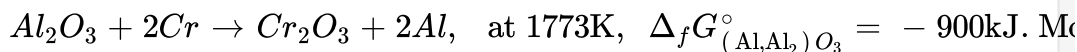
4. Extraction of copper from copper matte



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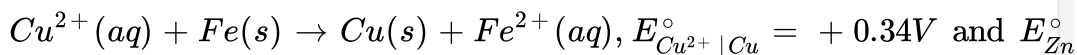
## Additional Question Predict Whether The Following Reactions Are Feasible Or Not

1. Predict whether the reaction is feasible or not



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2. Predict whether the reaction is feasible or not



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3.



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1. Out of C and CO which one is a better reducing agent at 673 K and why ?



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2. What is the percentage of copper in 'tough pitch'?



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3. Why is not blast furnace used for the extraction of zinc in carbon reduction process?



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4. Write down the composition of invar?



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5. What are cryolite and fluorspar added in alumina during extraction of aluminium?

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6. What is anode mud?

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7. Why is copper matte put in silica lined converter?

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8. Write down the differences between calcination and roasting?

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9. What is thermite mixture?



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10. Basic flux is used during extraction of iron whereas acidic flux is used during extraction of copper - why?



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