CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

N C E R T In Text Questions

1. Name some ores which 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. The reaction

$$Cr_2O_3 + 2A < oAl_2O_3 + 2Cr \left(\triangle G^{\ominus} = -421kJ \right)$$

Is thermodynamically feasible as is apparent from the Gibbs energy value.

Why does it not take place at room temperature?

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4. It is true that under certain condition, Mg can reduce Al_2O_3 and Al can reduce MgO? What are those conditions?

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N C E R T Exercise

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 copper from pyrites more difficult than that from its oxide ore through reduction?

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4. Explain:

(i). Zone refining

(ii). Column chromatography.

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

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

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

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

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

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10. What is meant by the term "chromatography"?

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11. What criterion is followed for the selectrion of the stationary phase in chromatography?

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12. Describe a method for refining nickel.

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

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14. Giving examples differentiate between roasting and calcination.

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15. How is cas iron different from pig iron ?

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

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

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18. How is leaching carried out in case of low grade copper ores?

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

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20. The value of $\Delta_f G^{\Theta}$ for formation of Cr_2O_3 is $-540kJmol^{-1}$ and that of Al_2O_3 is $-827kJmol^{-1}$. Is the reduction of Cr_2O_3 possible with Al ?

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21. Out of C and CO, which is better reducing agent for ZnO?

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22. 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 example.

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23. 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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24. What is the role of graphite rod in the electrometallurgy of aluminium?

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25. Outline the principles of refining of metals by the following methods :

(a) Electrolytic refining

(b) Zone refining

(c) Vapour phase refining.

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

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Short Answer Type Questions

1. Why is an external e.m.f of more than $2.2V$ required for the extraction of Cl_2 from brine ?

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2. At temperature above $1073K$ coke can be used to reduce FeO to Fe. How can you justify this reduction with Ellingham diagram?

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3. Wrought iron is the purest form of iron. Write a reaction used for the preparation of wrought iron from cast iron. How can the impurities of sulphur, silicon and phosphorus be removed from cast iron ?

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4. How is copper extracted from low grade copper ores?

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5. Write two basic requirements for refining of a metal by Mond process and by Van Arkel Method

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6. Although carbon and hydrogen are better reducing agents but they are not used to reduce metallic oxides at high temperatures. Why?

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7. How do we separate two sulphide ores by Froth Floatation Method? Explain with an example.

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8. The purest form of iron is prepared by oxidising impurities from cast iron in a reverberatory furnace. Which iron ore is used to line the furnace? Explain by giving reaction.

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9. The mixture of compounds A and B is passed through a column of Al_2O_3 by using alcohol as eluent. Compound A is eluted in preference to compound B. Which of the compounds A or B is more readily adsorbed on the column ?

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10. Why is sulphide ore of copper heated in a furnace afer mixing with silica?

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11. Why are sulphide ores converted to oxide before reduction?

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12. Which method is used for refining Zr and Ti? Explain with equation.

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13. What should be the considerations during the extraction of metals by electrochemical method?

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14. What is the role of flux in metallurgical processes?

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15. How are metals used as semiconductor refined? What is the principle of the method used?

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16. Write down the reactions taking place in Bast furnace related to the metallurgy of iron in the temperature range $500 - 800K$

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17. Give two requirements for vapour phase refining.

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18. Write the chemical reaction involved in the extraction of gold by cyanide process. Also give the role of zinc in the extraction.

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Long Answer Type Questions

1. Explain the following

(a) CO_2 is a better reducing agent below 710 K whereas CO is a better reducing agent above 710 K .

(b) Generally sulphide ores are converted into oxides before reduction.

(c) Silica is added to the sulphide ore of copper in the reverberatory furnance.

(d) Carbon and hydrogen are not used as reducing agents at high temperature.

(e) Vapour phase refining method is used for the purification of Ti

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Additional Important Questions

1. Pine oil is generally added in the froth floatation process. Explain.

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2. Answer the following questions briefly.

(i) What is the actual reducing agent of haematite in blast furnace ?

(ii) Give the equations for the recovery of lead from galena by air reduction.

(iii) Why is sodium chloride added during electrolysis of fused anhydrous magnesium chloride.

(iv) Zinc, not copper, is used for the recovery of metallic silver from the complex $\left[Ag(CN)_2\right]$. Explain.

(v) Why is chalcocite roasted and not calcinated during recovery of copper ?

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3. Why partial roasting of sulphide ore is done in the metallurgy of copper ?

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4. Aluminium metal is generally used for the extraction of chromium and manganese from their oxide ores. Explain.

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5. Graphite is used as anode and not diamond. Assign reason.

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6. Why magnesium oxide is used for the lining in steel making furnace?

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7. What is a flux ? What is its nature ? Name the substances which are formed when flux combines with gangue impurities.

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8. What is thermit process ? What is its utility ?

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

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10. Give reason : Reduction of Cr_2O_3 with Al is thermodynamically feasible, yet it does no occur at room temperature.

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11. Write one point of difference between electrolytic reduction and reduction with carbon. Give one example of each.

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12. Aluminium metal is not extracted directly from Bauxite ore. The ore is first purified to give pure alumina from which aluminium is isolated by electro reduction process. Explain.

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13. In moist air, copper corrodes to produce a green layer on the surface. Give reason.

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14. Roasting of an ore of a metal usually results in the conversion of the metal sulphide into oxide. Why does the roasting of cinnabar (HgS), produce metallic mercury and not its oxide ?

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Questions From Board Examinations

1. Name the method used for the refining of (i) Nickel (ii) Zirconium.

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2. The extraction of Au by leaching with $NaCN$ both oxidation and reduction. Justify giving equations.

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3. What is the role of following ?

(a) Depressant in the froth floatation process.

(b) Silica in the extraction of copper from copper pyrites.

(c) Cryolite in the metallurgy of aluminium.

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4. What is pyrometallurgy ?

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5. Why is froth floatation process selected for the concentration of the sulphide ore ?

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6. Explain the role of cryolite in the electrolytic reduction of alumina.

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7. Why can zinc oxide be reduced to the metal by heating with carbon and not with Cr_2O_3 ?

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

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9. State briefly the principles which serve as the basis for the following operations in metallurgy.

(i) Froth floatation process

(ii) Zone refining

(iii) Refining by liquation.

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10. What is the role of iodine in the refining of titanium ?

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11. Describe the role of NaCN in the extraction of gold from gold ore.

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12. What is the role of iodine in the refining of zirconium (Zr) ?

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13. How is zinc oxide converted into metallic zinc ?

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14. Outline the principle of the method used for refining of

(a) Nickel (b) Zirconium (c) Tin

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15. Differentiate between mineral and ore.

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16. Describe the principle controlling the extraction of cast iron from pig iron.

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17. Describe the principle behind the recovery of silver ore leached with NaCN.

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18. What happens when :

(i)Cu_2O undergoes self reduction in a silica lined converter.

(ii) Haematite oxidises carbon to carbon monoxide.

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19. (a) What role does cryolite play in Hall Harnoult process ?

(b) How can alumina be separated from silica in bauxite ore associated with silica ? Give equation also.

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20. Give one example each of (i) acidic flux (ii) basic flux.

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21. Distinguish between the following :

(a) Ores and minerals (b) Flux and slag (c) Calcination and roasting.

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22. Write about Alumino thermic process with examples.

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23. Name two important ores or iron. Write the method of extraction of iron and the chemical reactions involved in it.

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24. Write the important ores of aluminium and the principle of extraction of aluminium .

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25. Name a method used for removing gangue from sulphide ore.

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26. How is wrought iron different from steel ?

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27. Which reducing agent is employed to get copper from the low grade copper ore ?

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28. Outline the principle behind the refining of metals by chromatographic method.

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29. What is the role of zinc metal in the extraction of silver ?

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30. Write a short note on leaching with an example.

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31. How is iron extracted from its ore ? Explain with related chemical reactions.

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32. (i) Indicate the principle behind the method for the refining of nickel.

(ii) What is the role of dilute NaCN in the extraction of gold ?

(iii) What is copper matte ?

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33. (i) Name a method used for the refining of zirconium.

(ii) What is the role of CO in the extraction of iron ?

(iii) Reduction of metal oxide to metal becomes easier if the metal obtained is in the liquid state. Why ?

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34. (i) Indicate the principle behind the method used for the refining of zinc.

(ii) What is the role of silica in the extraction of copper ?

(iii) Which form of iron is the purest on commercial scale ?

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35. Write the names of the important ores of aluminium. Discuss the principle of extraction of metal from its ore.

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36. Write the names of any two ores of silver and give their chemical formula.

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37. Write principle behind the following :

(i) Vapour phase refining

(ii) Chromatography

(iii) Froth flatation process.

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38. (i) What is the role of cryolite in the extraction of aluminium ?

(ii) What is the role of limestone in the extraction of iron from its oxides ?

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39. What is the role of iodine in Van Arkel process ?

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40. Describe the role of

(i) NaCN in the extraction of gold from its ore.

(ii) Cryolite in the extraction of aluminium from pure alumina

(iii) CO in the purification of Nickel.

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41. Explain the magnetic separation of ores.

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42. What is Calcination ?

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43. Give Mond process for refining of nickel.

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Higher Order Thinking Skills

1. A student suggested that calcium could be obtained by reducing dolomite $(CaCO_3.MgCO_3)$ with aluminium powder. Was he correct in his approach ?

(Given

$\Delta_f G^\circ(CaO) = -640.0 \text{ kJ mol}^{-1}$, $\Delta_f G^\circ Al_2O_3(s) = -1580.0 \text{ kJ mol}$

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2. Gold dissolves in aqua regia but silver remains insoluble. Explain.

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3. Assuming complete recovery of metal, which of the following ores would yield a greater quantity of copper ?

(a) An ore azurite $\left(Cu(OH)_2.2CuCO_3\right)$ containing 3.30% (by mass)

(b) An ore chalcopyrite $CuFeS_2$ containing 4.95% (by mass).

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4. Complete the following :

$$Mg \xrightarrow[\text{heat}]{(\text{Air})} \underset{[A]}{\text{colourless solid}} \xrightarrow{\text{HCl}} \underset{[B]}{\text{colourless solution}} \xrightarrow{Na_2CO_3} \underset{[C]}{\text{white ppt}} \xrightarrow{\text{heat}} \text{col}$$

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5. Nitrogen is normally used to maintain an inert atmosphere in metallurgical operations. Why is helium used for the reduction of $TiCl_4$ with Mg metal ?

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6. Free energies of formation $\left(\Delta_f G\right)$ of MgO(s) and Co(g) at 1273 K and 2273 K are given below :

$\Delta_f G^\circ\left(MgO(s)\right) = -941 kJ/\text{mol at} 1273 K$

$\Delta_f G^\circ\left(MgO(s)\right) = -344 kJ/\text{mol at} 2273 K$

$\Delta_f G^\circ\left(CO(g)\right) = -439 kJ/\text{mol at} 1273 K$

$\Delta_f G^\circ\left(CO(g)\right) = -628 kJ/\text{mol at} 2273 K$

On the basis of the above data, predict the temperature at which carbon can be used as reducing agent for MgO(s).

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7. A sulphide ore (A) on roasting leaves a residue (B) which on reacting with HCl forms a water soluble compound (C). Addition of KI to the solution of (C), another solution (D) is formed. A brown precipitate (E) is formed when ammonia is passed into an alkaline solution of (D). Identify (A) to (E).

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8. A_1 and A_2 are the two ores of a metal M. They undergo the following changes. Identify the orea A_1 and A_2.

$$I_2 + ppt \xleftarrow[KI]{\text{Dil.HCl}} A_1 \xrightarrow{\text{Calcination}} \text{Black solid} + CO_2 + H_2O$$

$$A_2 \xrightarrow{\text{Roasting}} \text{Metal} + gas \xrightarrow[H_2SO_4]{K_2Cr_2O_7} \text{Green colour}$$

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9. Galena (an ore) is partially oxidised by passing air through it at high temperature. After some time the passage of air stopped, but the heating is continued in a closed furnace such that the contents undergo self-reduction. The weight (in kg) of Pb produced per kg of O_2 consumed is_ , Atomic weights in g mol^{-1} : $O = 16, S = 32, Pb = 207$

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N C E R T Exemplar Problems

1. In the extraction of chlorine by electrolysis of brine

A. oxidation of Cl^- ion to chlorine gas occurs.

B. reduction of Cl^- ion to chlorine gas occurs.

C. for overall reaction ΔG° has negative value.

D. a displacement reaction takes place.

Answer: C

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2. When copper ore is mixed with silica, in a reverberatory furnace, copper matte is produced. The copper 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

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3. Which of the following reactions is an example of autoreduction ?

A. $Fe_3O_4 + 4CO \rightarrow 3Fe + 4CO_2$

B. $Cu_2O + C \rightarrow 2Cu + CO$

C. $Cu^{2+}(aq) + Fe(s) \rightarrow Cu(s) + Fe^{2+}(aq)$

D. $Cu_2O + 1/2Cu_2S \rightarrow 3Cu + 1/2SO_2$

Answer: D

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4. A number of elements are available in earth's crust but most abundant elements are :

A. Al and Fe

B. Al and Cu

C. Fe and Cu

D. Cu and Ag

Answer: A

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5. Zone refining is based on the principle that

A. impurities of low boiling metals can be separated by distillation.

B. impurities are more soluble in molten metal than in solid metal.

C. different components of a mixture are differently adsorbed on an adsorbent.

D. vapours of volatile compound can be decomposed to give pure metal.

Answer: B

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6. In the extraction of copper from its sulphide ore, the metal is formed by the reduction of Cu_2O with

A. FeS

B. CO

C. Cu_2S

D. SO_2

Answer: C

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7. Brine is electrolysed by using inert electroldes. The reaction at anode is

A. $Cl^-(aq) \rightarrow 1/2Cl_2(g) + e^-, E^\circ_{\text{Cell}} = 1.36V$

B. $2H_2O(aq) \rightarrow O_2(g) + 4H^+(aq) + 4e^-, E^\circ_{\text{Cell}} = 1.23V$

C. $Na^+(aq) + e^- \rightarrow Na(s), E^\circ_{\text{Cell}} = 2.71V$

D. $H^+(aq.) + e^- \rightarrow 1/2H_2(g), E^\circ_{\text{Cell}} = 0.00V$

Answer: A

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8. In the metallurgy of aluminium

A. Al^{3+} is oxidised to Al (s)`

B. graphite anode is oxidised to carbon monoxide and carbon dioxide.

C. oxidation state of oxygen changes in the reaction at anode.

D. oxidation state of oxygen changes in the overall reaction involved in the process.

Answer: B

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9. Electrolytic refining is used to purify which of the following metals?

A. Cu and Zn

B. Ge and Si

C. Zr and Ti

D. Zn and Hg

Answer: A

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10. Extraction of gold and silver involves leaching the metal with CN^- ion. The metal is recovered by :

A. displacement of metal by some other metal from the complex ion.

B. roasting of metal complex.

C. calcination followed by roasting.

D. thermal decomposition of metal complex.

Answer: A

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11. 

Choose the correct option of temperature at which carbon reduces FeO to iron and produces CO.

A. Below temperature at point A.

B. Approximately at the temperature corresponding to point A.

C. A bove temperature at point A but below temperature at point D.

D. Above temperature at point A.

Answer: D

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12. 

Below point 'A' FeO can

A. be reduced by carbon monoxide only.

B. be reduced by both carbon monoxide and carbon.

C. be reduced by carbon only.

D. not be reduced by both carbon and carbon monoxide.

Answer: A

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13. 

For the reduction of FeO at the temperature corresponding to point D, which of the following statements is correct ?

A. ΔG value for the overall reduction reaction with carbon monoxide is zero.

B. ΔG value for the overall reduction reaction with a mixture of 2 mol carbon and 1 mol oxygen is positive.

C. ΔG value for the overall reduction reaction with a mixture of 2 mol carbon and 1 mol oxygen will be positive.

D. ΔG value for the overall reduction reaction with carbon monoxide is negative.

Answer: D

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14. At the temperature corresponding to which of the points in Fig. FeO will be reduced to Fe by coupling the reaction $2Fe \rightarrow 2Fe + O_2$ with all of the following reactions?

(a) $C + O_2 \rightarrow CO_2$ (b) $2C + O_2 \rightarrow 2CO$ and (c) $2CO + O_2 \rightarrow 2CO_2$

A. Point A

B. Point B

C. Point D

D. Point E.

Answer: B::D

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15. Which of the following options are correct ?

A. Cast iron is obtained by remelting pig iron with scrap iron and coke using hot air blast.

B. In extraction of silver, silver is extracted as 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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16. In the extraction of aluminium by Hall-Heroult process, purified Al_2O_3 is mixed with CaF_2 to

A. lower the melting point of Al_2O_3

B. increase the conductivity of molten mixture.

C. reduce Al^{3+} (aq) into Al (s).

D. act as catalyst.

Answer: A::B

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17. Which of the following statements is correct about the role of substances added in the froth floation processs ?

A. Collectors enhance the non-wettability of the mineral particles.

B. Collectors enhance the wettability of gangue particles.

C. By using depressants in the process two sulphide ores can be separated.

D. Froth stabilisers decrease wettability of gangue.

Answer: A::C

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18. In the frouth floatation process, zinc sulphide and lead sulphide can be separated by

A. using collectors.

B. adjusting the proportion of oil to water.

C. using depressant.

D. using froth stabilisers.

Answer: B::C

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19. Common impurities present in bauxite are

A. CuO

B. ZnO

C. Fe_2O_3

D. SiO_2

Answer: C::D

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20. Which of the following ores are concentrated by froth floatation ?

A. Haematite

B. Galena

C. Copper pyrites

D. Magnetite

Answer: B::C

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21. Which of the following reactions occur during calcination ?

A. $CaCO_3 \rightarrow CaO + CO_2$

B. $2FeS_2 + \frac{11}{2}O_2 \rightarrow Fe_2O_3 + 4SO_2$

C. $Al_2O_3.xH_2O \rightarrow Al_2O_3 + xH_2O$

D. $ZnS + \frac{3}{2}O_2 \rightarrow ZnO + SO_2$

Answer: A::C

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22. For the metallurgical process of which of the ores,calcined ore can be reduced by carbon ?

A. haematite

B. calamine

C. iron pyrites

D. sphalerite

Answer: A::B

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23. The main reactions occuring in blast furnace during extraction of iron from haematite ore.....

A. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

B. $FeO + SiO_2 \rightarrow FeSiO_3$

C. $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$

D. $CaO + SiO_2 \rightarrow CaSiO_3$

Answer: A::D

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24. In which of the following method of purification metal is converted to its volatile compound which is decomposed to give pure metal?

A. heating with stream of carbon monoxide.

B. heating with iodine.

C. liquation

D. distillation.

Answer: A::B

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25. Which of the following statements are correct ?

A. A depressant prevents certain type of particles to come to the froth.

B. Copper matte contains Cu_2S and ZnS.

C. The solidified copper obtained from reverberatory furnance has blistered appearance due to evolution of SO_2 during the extraction.

D. Zinc can be extracted by self-reduction.

Answer: A::C

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26. In the extraction of chlorine from brine_____

A. ΔG° for the overall reaction is negative.

B. ΔG° for the overall reaction is positive

C. E° for overall reaction has negative value.

D. E° for overall reaction has positive value.

Answer: B::C

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Matching Type Questions

1. Match the items of Column I with items of Column II

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2. Match the items of Column I with items of Column II

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3. Match the items of Column I with items of Column II

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4. Match the items of Column I with items of Column II

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5. Match the items of Column I with items of Column II

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Assertion Reason

1. Assertion : Nickel can be purified by Mond processs.

Reason : $Ni(CO)_4$ is a volatile compound which decomposes at 460 K to give pure Ni.

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is false but reason is false.

D. Assertion is false but reason is true.

Answer: A

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2. Assertion : Zirconium can be purified by Van Arkel method.

Reason : Zrl_4 is volatile and decomposes at 1800 K.

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is false but reason is false.

D. Assertion is false but reason is true.

Answer: A

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3. Assertion : Sulphide ores are concentrated by Froth Floatation method.

Reason : Cresols stabilise the froth in Froth Floatation method.

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is false but reason is false.

D. Assertion is false but reason is true.

Answer: B

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4. Assertion : Zone refining method is very useful for producing semiconductors.

Reason : Semiconductors are of high purity .

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is false but reason is false.

D. Assertion is false but reason is true.

Answer: B

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5. Assertion : Hydrometallurgy involves dissolving the ore in a suitable reagent followed by precipitation by a more electropositive metal.

Reason : Copper is extracted by hydrometallurgy.

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is false but reason is false.

D. Assertion is false but reason is true.

Answer: B

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Assignment

1. Which 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 reducing agent in each case.

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2. Name the principle ore of aluminium. How is the metal extracted from this ore ?

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3. What is the role of NaCN in the extraction of silver from silver ore ?

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4. Explain why zinc oxide can be reduced to metal by heating with carbon and not with Cr_2O_3.

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5. How is copper metal extracted from its sulphide ore ?

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6. What is flux ? Give one example each of acidic and basic flux.

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7. Why do some metals occur in the native rate ?

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8. Define calcination.

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9. State briefly the principles which serve as basis for the following operations in metallurgy.

(i) Froth flatation process (ii) Zone refining

(iii) Refining by liquation .

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10. Give definitions of following along with examples.

(a) Calcination

(b) Roasting

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11. What happens when :

(i)Cu_2O undergoes self reduction in a silica lined converter.

(ii) Haematite oxidises carbon to carbon monoxide.

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12. What role does cryolite play in Hall Harnoult process ?

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13. Distinguish between the following :

(a) Ores and minerals (b) Flux and slag (c) Calcination and roasting.

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14. Name two important ores of iron.

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15. Write the method of extraction of iron and the chemical reactions involved in it .

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16. Name a method used to remove gangue impurity from sulphide.

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17. How is wrought iron different from steel ?

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18. Which reducing agents are employed to get copper from the leached low grade copper ore ?

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19. What is the role of zinc metal in the extraction of silver ?

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20. What is the role of NaCN in the extraction of gold ?

(ii) What is copper matte ?

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21. (i) Mention the principle behind the zone refining of metals.

(ii) Which form of iron is the pures form of commercial iron ?

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22. What is the role of silica in the extraction of copper ?

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23. Write the names of any two ores of silver and give their chemical formula.

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24. (a) Name the method of refining of nickel.

(b) What is the role of cryolite in the extraction of aluminium ?

(c) What is the role of limestone in the extraction of iron from its oxides ?

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25. (a) Name one important ore of aluminium. Give its chemical composition.

(b) How is copper extracted from low grade ore ?

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Multiple Choice

1. The important ore of iron is :

A. Siderite

B. Haemaite

C. Pyrites

D. Bauxite.

Answer: B

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2. In the electrolytic process for the extraction of aluminium, the electrolyte is :

A. $Al(OH)_3$ in NaOH solution

B. An aqueous solution of $Al_2(SO_4)_3$

C. A molten mixture of Al_2O_3 and Na_3AlF_6

D. A molten mixute of Al_2O_3 and $Al(OH)_3$

Answer: C

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3. Cassiterite is an ore of :

A. Mn

B. Ni

C. Sb

D. Sn.

Answer: D

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4. In the extraction of iron, the slag produced is :

A. CO

B. $FeSiO_3$

C. $MgSiO_3$

D. $CaSiO_3$

Answer: D

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5. Heating pyrites to remove sulphur is called :

A. Smelting

B. Calcination

C. Liquation

D. Roasting.

Answer: D

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6. Nickel is purified by thermal decomposition of its

A. Hydride

B. Chloride

C. Azide

D. Carbonyl

Answer: D

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7. The most abundant element in the earth's crust (by weight) is :

A. Si

B. Al

C. O

D. Fe

Answer: C

View Text Solution

8. The process of converting hydrated alumina into anhydrous alumina is called :

A. Roasting

B. Calcination

C. Dressing

D. Smelting

Answer: B

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9. Colemanite is :

A. $Na_2B_4O_7.10H_2O$

B. $Na_2B_6O_{11}.5H_2O$

C. $NaBO_2$

D. H_3BO_4

Answer: B

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10. In the thermite process, the reducing agent is :

A. Nickel

B. Zinc

C. Sodium

D. Aluminium

Answer: D

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11. Which of the following metals present as impurity passes into solution during electrorefining of copper ?

A. Zinc

B. Silver

C. Gold

D. Platinum.

Answer: A

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12. Which of the following processes is used in the extractive metallurgy of magnesium ?

A. Fused salt electrolysis

B. Self reduction

C. Aqueous solution electrolysis

D. Thermite reduction.

Answer: A

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13. Which solution is used as electrolyte in the extraction of aluminium metal ?

A. $Al_2O_3.H_2O$

B. Al_2O_3 and Na_3AlF_6 (molten solution)

C. Al_2O_3

D. None of these

Answer: B

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14. CN^- solution is used in the extraction of which metal ?

A. Ag

B. Ti

C. Zn

D. Sn.

Answer: A

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15. A cuprous ore among the following is :

A. Malachite

B. Cuprite

C. Azurite

D. Chalcopyrite

Answer: B

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16. All ores are minerals while all minerals are not ores because :

A. the metal cannot be extracted economically from all the minerals

B. minerals are complex compounds

C. the minerals are obtained from mines

D. all of these are correct.

Answer: A

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17. The process used for the extraction of sodium is called :

A. Serpeck's process

B. Baeyer's process

C. Thermite process

D. Haber's process

Answer: D

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18. The common method for the extraction of metals from the oxide ore is :

A. reduction with carbon

B. reduction with hydrogen

C. reduction with aluminium

D. electrolytic method.

Answer: A

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19. Which of the following is not an ore of iron ?

A. Limonite

B. Magnetite

C. Caniterite

D. None of these

Answer: C

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20. Which of the following processes is used in the extractive metallurgy of magnesium ?

A. Fused salt electrolysis

B. Self reduction

C. Aqueous solution electrolysis

D. Thermite reduction.

Answer: A

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21. The method of zone refining of metals is based on the principle of :

A. greater mobility of the pure metal than that of the impurity

B. higher melting point of the impurity than that of the pure metal

C. greater noble character of solid metal than that of the impurity

D. greater solubility of the impurity in the molten state than in the solid

Answer: D

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22. Pb and Sn are extracted from their chief ore by :

A. carbon reduction and self reduction

B. self reduction and carbon reduction

C. electrolysis and self reduction

D. self reduction and electrolysis

Answer: B

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23. Which of the following is not an ore of magnesium ?

A. Carnallite

B. Dolomite

C. Calamine

D. Sea water.

Answer: C

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24. Extraction of zinc from zinc blende is achieved by

A. electrolyte reduction

B. roasting followed by reduction with carbon

C. roasting followed by reduction with another metal

D. roasting followed by self reduction

Answer: B

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25. Which of the following statements about the advantage of roasting of sulphide ore before reduction is not true ?

A. The ΔG° of the sulphide is greater than those of CS_2 and H_2S.

B. The ΔG° is negative for roasting of sulphide ore to oxide.

C. Roasting of sulphide to oxide is thermodynamically feasible

D. Carbon and hydrogen are not suitable reducing agents for metal sulphides.

Answer: D

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26. Sulphide ores of the metals are usually concentrated by froth floatation process. Which of the following sulphide ores offers an exception and is concentrated by chemical leaching ?

A. Galena

B. Copper pyrite

C. Sphalerite

D. Argentite.

Answer: D

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27. Which of the following is not an ore of aluminium ?

A. Anglesite

B. Mica

C. Beryl

D. Orthoclass.

Answer: A

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28. Which of the following factors is of no significance for roasting sulphide ore to the oxide and not subjecting sulphide ore to carbon reduction directly ?

A. CO_2 is more volatile thanCS_2

B. Metal sulphides are thermodynamically more stable than CS_2

C. CO_2 is thermodynamically more stable than CS_2

D. Metal sulphides are less stable than the corresponding oxides.

Answer: A

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29. When compared to ΔG° for the formation of Al_2O_3, ΔG° for the formation of Cr_2O_3 is :

A. same

B. unprdicated

C. lower

D. higher.

Answer: D

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30. Native silver metal forms a water soluble complex with a dilute solution of NaCN in the presence of :

A. nitrogen

B. oxygen

C. carbon dioxide

D. argon

Answer: B

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31. Which method of purification is represented by the following equations ?

$$Ti(s) + 2I_2(g) \xrightarrow{523K} TiI_4(g) \xrightarrow{1700K} KTi(s) + 2I_2(g)$$

A. Zone

B. Cupellation

C. Poling

D. Van Arkel Method.

Answer: D

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32. Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of :

A. $Al_2O_3 + HF + NaAlF_4$

B. $Al_2O_3 + CaF_2 + NaAlF_6$

C. $Al_2O_3 + Na_3AlF_6 + CaF_2$

D. $Al_2O_3 + KF + Na_3AlF_6$

Answer: C

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33. Which one of the following is a mineral of iron ?

A. Malachite

B. Cassiterite

C. Pyrolusite

D. Magnetite

Answer: D

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34. In the cyanide extraction process of silver from argentite ore, the oxidising and reducing agents are

A. O_2 and CO respectively

B. O_2 and Zn respectively

C. HNO_3 and Zn dust respectively

D. HNO_3 and CO respectively.

Answer: B

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35. Sulphide ores are common for the metals

A. Ag, Cu and Pb

B. Ag, Cu and Sn

C. Ag, Mg and Pb

D. Ab, Cu and Pb.

Answer: A

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36. The metallic lustre of metals is due to :

A. high density of metals

B. high polish on the metal surface

C. reflection of light by electrons

D. Chemical inertness of metals.

Answer: C

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37. The process of zone refining is used in the purification of :

A. Al

B. Ge

C. Cu

D. Ag.

Answer: B

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38. Which is an oxide ore ?

A. Zincite

B. Calamine

C. Malachite

D. Cryolite.

Answer: A

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39. In the metallurgy of iron, when lime stone is added to blast furnace, calcium end up in :

A. Slag

B. Gangue

C. Metallic calcium

D. Calcium carbonate.

Answer: A

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40. The statement that is NOT correct is that

A. a furnace lined with Haematite is used to convert cast iron to wrought iron.

B. collectors enhance the wettability of mineral particles during froth floatation.

C. in vapour phase refining, metal should form a volatile compound.

D. copper from its low grade ores is extracted by hydrometallurgy.

Answer: B

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41. Cryolite is

A. Na_3AlF_6 and is used in the electrolysis of alumina for lowering the melting point of alumina only

B. Na_3AlF_6 and is used in the electrolytic refining of alumina

C. Na_3AlF_6 and is used in the electrolysis of alumina for decreasing electrical conductivity

D. Na_3AlF_6 and is used in the electrolysis of alumina for lowering the melting point and increasing the conductivity of alumina.

Answer: B

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42. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with :

A. carbon monoxide

B. copper (I) sulphide

C. sulphur dioxide

D. iron (II) sulphide

Answer: B

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43. Metals are usually not found as nitrates in their ores. Out of the following two (I and II) reasons which is/ are true for the above observation ?

I. Metal nitrates are highly unstable.

II. Metal nitrates are highly soluble in water.

A. I is false but II is true.

B. I is true but II is false

C. I and II are true

D. I and II are false

Answer: A

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44. 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. Na_3AlF_6 serves as the electolyte

C. CO and CO_2 are produced in this process

D. Al_2O_3 is mixed with CaF_2 which lowers the metling point of the mixture and brings conductivity

Answer: D

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45. Roasted gold ore $+CN^- + H_2O \xrightarrow{O_2} [X] + OH^-$

A. $X = \left[Au(CN)_2\right]^-, Y = \left[Zn(CN)_4\right]^{2-}$

B. $X = \left[Au(CN)_4\right]^{3-}, Y = \left[Zn(CN)_4\right]^{2-}$

C. $X = \left[Au(CN)_2\right], Y = \left[Zn(CN)_6\right]^{2-}$

D. $X = \left[Au(CN)_4\right]^{3-}, Y = \left[Zn(CN)_6\right]^{4-}$

Answer: A

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46. Which of the following ores is best concentrated by Froth Floatation process ?

A. Magnetite

B. Siderite

C. Galena

D. Malachite.

Answer: C

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47. Which of the following is a carbonate ore ?

A. Cuprite

B. Siderite

C. Zincite

D. Bauxite.

Answer: B

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48. Extraction of gold and silver involves leaching the metal with CN^- ion. Sliver is later recovered by :

A. distillation

B. zone refining

C. displacement

D. liquation.

Answer: C

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49. Purification of alumina by electrorefining is known as :

A. Hall's process

B. Froth flatation process

C. Baeyer's process

D. Hoope's process

Answer: D

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

A. Mg

B. Zn

C. Fe

D. Cu

Answer: A

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51. Cassiterite is an ore of :

A. Sb

B. Ni

C. Sn

D. Mn

Answer: C

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52. The first step in the extraction of copper is :

A. reduction of copper (I) oxide with copper (II) sulphide

B. reduction with iron

C. heating ore with coke

D. roasting of copper (I) sulphide

Answer: D

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53. Assertion : Zone refining is based on the solubilities of impurities in the molten state than in the solid state of a metal.

Statement : Pure metal oxide is obtained in zone refining.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: C

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Multiple Correct Options

1. Metals which donot form amalgam ore :

A. Fe

B. Ni

C. Zn

D. Au.

Answer: A::B

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2. Which of the following ores are oxide ores ?

A. Cassiterite

B. Bauxite

C. Cryolite

D. Haematite.

Answer: A::B::C

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3. Which of the following metals are extracted by electrolytic reduction ?

A. Cu

B. Al

C. Mg

D. Ag.

Answer: B::C

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4. Which of the following are correct reactions ?

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

B. $ZnO + C \rightarrow Zn + CO$

C. $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

D. $2\left[Ag(CN)_2\right]^{1-} + Zn \rightarrow 2Ag + \left[Zn(CN)_4\right]^{2}$

Answer: B::C::D

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5. Extraction of a metal from ore cassiterite involves :

A. Carbon reduction f the oxide ore.

B. Self reduction of the sulphide ore

C. removal of copper impurity

D. removal of iron impurity.

Answer: A::C::D

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6. The major role of fluorspar (CaF_2) which is added in small amount in the electrolytic reduction of Al_2O_3 dissolved in fused cryolite is :

A. to act as catalyst

B. to make fused mixture conducting

C. to lower the fusion temperture of melt

D. to decrease the rate of oxidation of carbon at the anode.

Answer: B::C

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7. Copper is purified by electro-refining of blister copper. The correct statement (s) about this process is (are)

A. Impure copper strip is used as cathode

B. Acidified aqueous $CuSO_4$ is used as electrolyte

C. Pure copper is deposited at cathode

D. Impurities settle as anode-mud.

Answer: B::C::D

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8. Which of the following is/are not method(s) for refining of metals ?

A. Poling

B. Cupellation

C. Goldschmidit aluminothermic process

D. Smelting

Answer: C::D

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9. Extraction of copper from copper pyrite $(CuFeS_2)$ involves

A. Crushing followed by concentration of the ore by froth floatation process.

B. removal or iron as slag.

C. Self-reduction process to produce blister copper following evolution of SO_2.

D. refining blister copper by carbon reduction.

Answer: A::B::C

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10. The role of fluorspa, which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite is to

A. act as a catalyst

B. make fused mixture conducting.

C. lower the melting temperature of the mixture.

D. decrease the rate of oxidation of carbon at anode.

Answer: B::C

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Comprehension Linked

1. Copper is the most noble among the first row transition metals and occurs in small deposits in several countries. Ores of copper include chalcopyrite $(CuFeS_2)$, cuprite (Cu_2O), copper glance (Cu_2S) and malachite $\left[CyCO_3.Cu(OH)_2\right]$. However 80% of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. the extraction of copper from chalcopyrite involves partial roasting , removal of ironand self-reduction.

Partial roasting of chalcopyrite produces

A. Cu_2S and FeO

B. Cu_2 and FeO

C. CuS and Fe_2O_3

D. Cu_2O and F_2O

Answer: A

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2. Copper is the most noble among the first row transition metals and occurs in small deposits in several countries. Ores of copper include chalcopyrite $(CuFeS_2)$, cuprite (Cu_2O), copper glance (Cu_2S) and malachite $\left[CyCO_3.Cu(OH)_2\right]$. However 80% of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. the extraction of copper from chalcopyrite involves partial roasting , removal of ironand self-reduction.

Iron is removed from chalcopyrite as

A. FeO

B. FeS

C. Fe_2O_3

D. $FeSiO_3$

Answer: D

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3. Copper is the most noble among the first row transition metals and occurs in small deposits in several countries. Ores of copper include chalcopyrite $(CuFeS_2)$, cuprite (Cu_2O), copper glance (Cu_2S) and malachite $\left[CyCO_3.Cu(OH)_2\right]$. However 80% of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. the extraction of copper from chalcopyrite involves partial roasting , removal of ironand self-reduction.

In self-reduction, the reducing species is

A. S

B. O^{2-}

C. S^{2-}

D. SO_2

Answer: C

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Assertion Reason Type Questions

1. Assertion : Gold occurs in native state.

Reason : Gold dissolves in aqua-regia.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: B

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2. Assertion : Froth flatation process is used to concentrate sulphide ores.

Reason : There is a difference in the nature of wettibility of different ores.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: A

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3. Assertion : $\Delta_f G^\circ$ for the formation of Al_2O_3 and Cr_2O_3 involving one mole of oxygen are $-827\ \text{kJ mol}^{-1}$ and $-540\ \text{kJ mol}^{-1}$

respectively

Reason : Al can reduce Cr_2O_3 since $\Delta_f G^2$ for its formation is less.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: A

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4. Assertion : Reduction of ZnO with carbon is done at $1100^\circ C$.

Reason : At this temperature, ΔG° is negative and the process is spontaneous.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: A

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5. Assertion : Desilverisation of lead is done by Parke's method ΔG.

Reason : When lead-silver alloy is poor in silver, zinc is added to molten ore.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: B

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6. Assertion : Zinc is used for the recovery of silver from the complex $[Ag(CN)_2]^-$

Reason : Zinc is more electropositive than silver and is a better reducing agent.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: A

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7. Assertion : Aluminium is used for the extraction of chromium from its oxide

Reason : Aluminium has high melting point.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: B

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8. Assertion : Magnesium oxide is used for brick lining in steel making furnace.

Reason : It reacts with acidic impurities through slag formation.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: A

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9. Assertion : Silver and gold are extracted from their ores by the process of leaching with dilute NaCN.

Reason : Impurities associated with these ores dissolve in NaCN.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: C

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10. Assertion : Zone refining of metals is based on fractional crystallistion theory.

Statement : By Van Arkel Method, the metals Titanium (Ti) and Germanium (Ge) are found in highest degree of purity.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Assertion is wrong, but reason is correct statement.

Answer: B

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Matrix Match Type Questions

1. Match the items in column I with items in column II and assign the correct code

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2. Match column I with column II and select the correct answer using the codes given in the list.

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3. Match column I with column II and select the correct answer using the codes given in the list.

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Brain Storming Multiple Chocie Questions

1. When the sample of Cu with Zn as impurity is to be purified by electrolysis, the appropriate electrodes are :

A. Cathode Anode
Pure Zn Pure Cu

B. Cathode Anode
Impure sample Pure Cu

C. Cathode Anode
Impure Zn Impure sample

D. Cathode Anode
Pure Cu Impure sample

Answer: D

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2. The phenomenon in which white transparent crystal changes into white power is known as

A. Sublimation

B. Allotropy

C. Effloroscence

D. Deliquescence.

Answer: C

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3. The incorrect statement among the following is :

A. Calamine and siderite are carbonates

B. Argentite and cuprite are oxides

C. Zinc blende and iron-pyrites are sulphides

D. Malachite and azurite are ores of Cu.

Answer: C

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4. Choose the right method for each :

A. Ni : Electrolysis , Cu : Van Arkel process ,

Zn : Zone refining

B. Ni : Mond's process , Cu , Electrolysis ,

Zr : Van Arkel process , Ga : Zone refining

C. Ni : Mond's process , Cu : Van Arkel process ,

Zr : Zone refining , Ga : Electrolysis

D. Ni : Electrolysis , Cu : Zone refining ,

Zr : Van Arkel process , Ga : Mond 's process.

Answer: B

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5. Aluminothermic process is used for the extraction of metals whose oxides are :

A. fusible

B. not easily reduced by carbon

C. not easily reduced by hydrogen

D. strongly basic.

Answer: B

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6. Alloy 

Select the correct statement based on the above scheme :

A. Layer X contains Zinc & Silver

B. Layer Y contains lead & silver but the amount of silver in the layer Y is smaller than in the layer X

C. X and Y immiscible layers

D. All are correct statements

Answer: D

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7. Copper Matte is extracted from copper pyrites ore by heating it in blast furnace. The method is based on the principle that:

A. copper has more affinity for oxygen than for sulphur at high temperature

B. iron has less affinity for oxygen than for sulphur at high temperature

C. sulphur has less affinity for oxygen at high temperature

D. copper has less affinity for oxygen than for sulphur at high temperature.

Answer: A

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