



CHEMISTRY

BOOKS - MTG CHEMISTRY (ENGLISH)

GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

Mcqs

1. Which of the following examples is not correctly matched

?

A. (A) Two most abundant elements - Fe, Al.

B. (B) Two metals which occur in native state - Au, Pt.

C. (C) Two metals which can occur in combined and native state both -Zn, Fe

D. (D) None of these

Answer: C

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2. Which of the following is not the correct name of the formula of the ore given with it ?

A. $MgSO_4 \cdot 7H_2O$ - Epsom salt

B. $CuCO_3 \cdot CU(OH)_2$ -Malachite

C. $KAlSi_3O_8$ -Feldspar

D. $KCl \cdot MgCl_2 \cdot 6H_2O$ Dolomite

Answer: D

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3. In which of the following the name of the ore is not matched with its formula ?

A. Cassiterite - SnO_2

B. Limonite - $Fe_2O_3 \cdot 3H_2O$

C. Siderite - $FeCO_3$

D. Anglesite - $PbCO_3$

Answer: D

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4. Pyrolusite is

- A. a sulphide ore of Mn
- B. an oxide ore of Mn
- C. a carbide ore of P
- D. a chloride ore of Zn.

Answer: B

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5. The metal which can be extracted from the bauxite ore is:

A. Malachite -Cu

B. Calamine-Zn

C. Chromite -Cr

D. Dolomite -Al

Answer: D



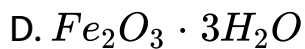
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6. Which of the following is magnetite ?

A. Fe_2CO_3

B. Fe_2O_3

C. Fe_3O_4



Answer: C

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

A. Carnallite

B. Magnesite

C. Dolomite

D. Gypsum

Answer: D

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8. Which of the following is not an ore?

A. Corundum

B. Zincite

C. Calamine

D. Chromite

Answer: C

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9. Which one of the following is not a sulphide ore ?

A. Galena

B. Iron pyrites

C. Magnetite

D. Copper glance

Answer: C



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10. An example of halide ore is

A. Cassiterite

B. Anglesite

C. Siderite

D. Carnallite

Answer: D

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11. Which of the following is not a carbonate ore?

A. Dolomite

B. Calamine

C. Siderite

D. Zincite

Answer: D

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12. Find the incorrect match.

A. Kaolinite – $[Al_2(OH)_4Si_2O_5]$

B. Siderite – Fe_2O_3

C. Sphalerite – ZnS

D. Magnetite – Fe_3O_4

Answer: B

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13. Removal of the unwanted materials from the ore is known as

A. concentration , dressing , benefaction

B. separation, refining, gangue

C. magnetic separation, purification, gangue

D. washing, refining, amalgamation

Answer: A

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14. The powdered ore is agitated with water or washed with running stream of water. The heavy ore particles and lighter impurities are separated. This method of concentration is known as

A. metallurgy

B. leaching

C. gravity separation

D. froth floatation process.

Answer: C



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15. Which one of the following scrap metal cannot be separated by magnetic separation ?

A. (A)Haematite

B. (B)Malachite

C. (C)Magnetite

D. (D)Siderite

Answer: B

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16. An ore of tin containing $FeCrO_4$ is concentrated by _____.

- A. gravity separation
- B. magnetic separation
- C. froth floatation
- D. leaching

Answer: B

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17. Sulphide ore of copper can be concentrated by

- A. (A)Forth flotation process
- B. (B)electromagnetic process
- C. (C)gravity separation
- D. (D)distillation

Answer: A

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18. For which ore of the metal, froth floatation method is used for concentration?

- A. Haematite

B. Zinc blende

C. Magnetite

D. Carnallite

Answer: B



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19. Which of the following statements is correct about the role of substances added in the froth floatation process?

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

B. Collectors enhance the wettability of gangue particles.

C. Collectors help in separating two sulphide ores present in the mixture.

D. Collectors helps ore particles to settle down below the froth .

Answer: A

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20. Froth floatation process is used to concentrate:

- A. preferential wetting properties with the frothing agent and water.
- B. difference in the specific gravities of gangue and ore particles.
- C. difference in solubility of gangue and ore particles in frothing agent and water
- D. difference in reactivity of gangue and ore particles with water and frothing agent.

Answer: A



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

A. coconut oil

B. cartor oil

C. plamitic oil

D. pine oil.

Answer: D



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22. How do we separate two sulphide ores by froth floatation method?

A. by using excess of pine oil

B. by adjusting proportion of oil to water or using depressant .

C. By using collectors and froth stabilisers like xanthates.

D. By using some solvent in which one of the sulphides is soluble.

Answer: B

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23. Sometimes, it is possible to separate two sulphide ores by adjusting proportion of oil to water or by using

depressants. In case of an ore containing ZnS and PbS, the depressant used is

A. NaCN prevents PbS from coming to the froth but allows ZnS to come with froth .

B. NaCN prevents ZnS from coming to the froth but allows PbS to come with froth.

C. NaCN prevents frothing of both ZnS and PbS, hence no froth is formed.

D. NaCN does not act as depressant hence a mixture of PbS and ZnS is found in froth.

Answer: B



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24. the common impurities present in bauxite are

A. CuO

B. ZnO

C. CaO

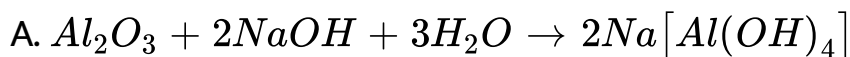
D. SiO_2

Answer: D

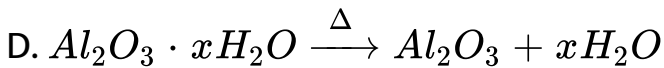
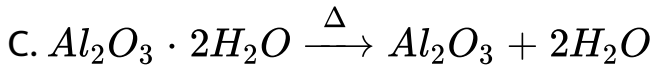
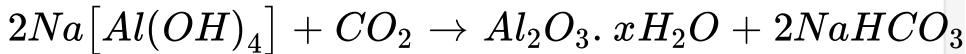


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25. Which of the following reactions does not take place during leaching for concentration of bauxite ?



B.



Answer: C



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26. The significance of leaching in the extraction of aluminum is

A. it helps removing the impurities like SiO_2 , Fe_2O_3 ,
etc from the bauxite ore

- B. it converts the ore into oxide
- C. it reduces the melting point of the ore
- D. it eliminates water from bauxite.

Answer: A

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27. Which one of the following ores is treated by chemical leaching

- A. Cinnabar
- B. Argentite
- C. Copper pyrites

D. Galena

Answer: B

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28. Which of the following metals is not extracted by leaching ?

A. Aluminium

B. Mercury

C. Silver

D. Gold

Answer: B

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

- A. Leaching is carried out with NaOH and O_2
- B. Leaching is carried out with NaCN.
- C. Leaching is carried out with acids in presence of H_2 .
- D. Leaching is carried out by boiling the ore with water.

Answer: C

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30. Which of the following changes take place during roasting ?

(i) Impurities are removed as they form volatile oxides.

(ii) Ore is converted into their volatile oxides.

(iii) Changes like oxidation , chlorination, etc. take place

A. (i) and (ii)

B. (ii) and (iii)

C. (i) and (iii)

D. (i), (ii) and (iii)

Answer: D



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31. Heating pyrites to remove sulphur is called

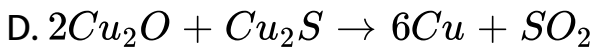
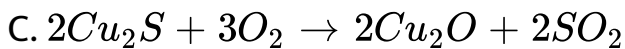
- A. smelting
- B. calcination
- C. liquation
- D. roasting

Answer: D

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32. Which of the following is not an example of roasting ?

- A. $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
- B. $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$



Answer: D



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33. Fill in the blanks with the correct choice.

The undesired impurities present in the ores are called

____ (i) ____ . To remove the volatile impurities from the ore, the

____ (ii) ____ process is carried out. Flux combines with non-fusible

impurities to form ____ (iii) ____ . CaO acts as a ____ (iv) ____ flux.

A. gangue roasting slag acidic

B. gangue calcination slag basic

C. anode mud leaching matrix acidic

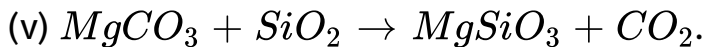
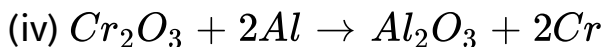
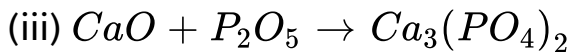
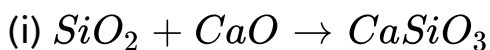
D. gangue roasting solution acidic

Answer: B



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34. How many reactions can show slag formation process from the given reaction ?



A. (i) SiO_2 - Acidic flux (ii) MgO — Basic flux

B. (i) SiO_2 - Basic flux (ii) MgO - Acidic flux

C. (i) SiO_2 - Basic flux (ii) MgO -Basic flux

D. (i) SiO_2 -Acidic flux (ii) MgO -Acidic flux

Answer: A



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35. Explain the following

(i) Chalcocite is roasted and not calcined during recovery of copper.

(ii) Magnesium oxide is used for lining in steel making furnace

- A. MgO acts as an acidic flux to remove impurities of Si, P and S
- B. MgO acts as a basic flux to remove impurities of Si P and S
- C. MgO acts as an oxidising agent to removing impurities of oxides
- D. MgO does not react with any type of impurities

Answer: B

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36. Which of the following metals is extracted using silica lined convertor ?

A. Mg

B. Al

C. Cu

D. Zn

Answer: C



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37. 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?

A. carbon which reduce the impurities

B. water which dissolves the impurities

C. limestone which changes impurities into oxides and pass into slag

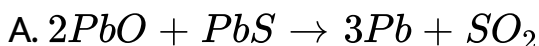
D. iron oxide which reacts with impurities by forming slag.

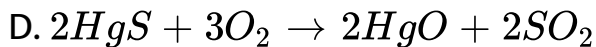
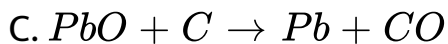
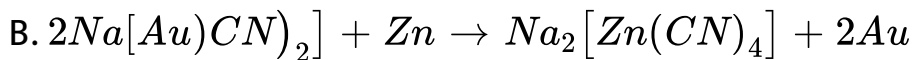
Answer: C



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38. Which of the following reactions show the process of smelting ?

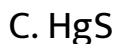




Answer: C

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39. Which of the following sulphides when heated without undergoing separated reduction of oxide ?



D. ZnS

Answer: C

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40. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Highly electropositive metals	(i)	Carbon reduction
(B)	Copper	(ii)	CO reduction
(C)	Iron	(iii)	Self reduction
(D)	Zinc	(iv)	Electrolysis

A. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

B. (A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (i), (D) \rightarrow (iv)

C. $(A) \rightarrow (ii)$, $(B) \rightarrow (i)$, $(C) \rightarrow (iii)$, $(D) \rightarrow (iv)$

D. $(A) \rightarrow (i)$, $(B) \rightarrow (ii)$, $(C) \rightarrow (iii)$, $(D) \rightarrow (iv)$

Answer: A



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41. Ellingham diagram represents:

A. ΔG with temperature

B. ΔH with temperature

C. ΔH with pressure

D. $(\Delta G - T\Delta S)$ with temperature

Answer: A



42. Which of the following statements is correct according to the basic concepts of thermodynamics which govern the feasibility of a metallurgical process ?

A. When the value of ΔG is positive for the equation

$$\Delta G = \Delta H - T\Delta S, \text{ the reaction will proceed.}$$

B. If reactant and products of two reactions are put together and net ΔG is -ve , the overall reaction will occur.

C. On increasing the temperature , the value of ΔG reaction will occur.

D. Feasibility of thermal oxidation of an ore can be established by Ellingham diagram in which a straight line shows the reduction will proceed.

Answer: B

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

A. Sulphides cannot be reduced easily while oxides can be reduced easily.

- B. Sulphides decompose on reduction hence they are first converted to oxides
- C. Sulphides ore have higher melting points than oxides.
- D. Oxides are more stable than sulphides hence easy to reduce.

Answer: A

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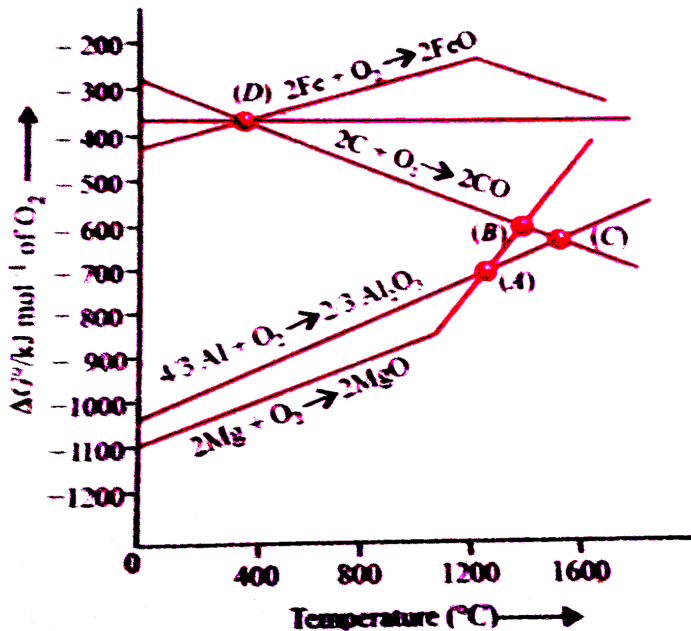
44. The metal oxide reacts with a _____ . The oxides is _____ to metal and reducing agent is _____ . Net Gibbs energy change is _____ .

- A. a. reducing agent, oxidised, reduced , negative
- B. b. reducing agent , reduced , oxidised , negative
- C. c. oxidising agent, reduced , oxidised , positive
- D. d. reducing agent , reduced , oxidised , positive.

Answer: B



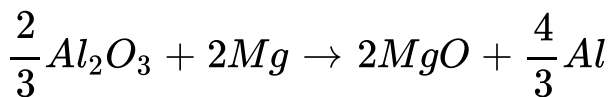
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45.

At the points of intersection of Al_2O_3 and MgO curves (A),

ΔG° becomes zero for reaction,



Above this point, magnesium can reduce alumina.

Although thermodynamically feasible, Mg is not used to reduction of Al_2O_3 because

A. a. temperature required is very high

B. b. the yield of metal is very low

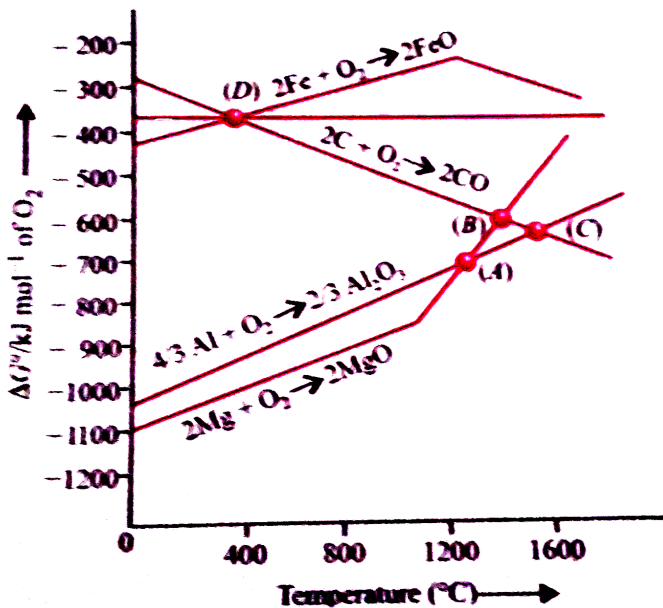
C. c. value of ΔG becomes positive

D. d. magnesium is not used as reducing agent for any reaction.

Answer: A



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46.

For the reduction of FeO with C at the temperature corresponding to (D), which of the following statements is correct ?

A. carbon reduces FeO below the temperature at point

(D)

B. ΔG° value for overall reduction with CO is zero.

C. ΔG° value for the reaction at point (D) is positive .

D. Below point (D) , for the metal exists in molten state.

Answer: B



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47. Which of the following is not correct observation on Ellingham diagram ?

A. A metal can reduce the oxide of other metal which lies below it in Ellingham diagram .

B. CO is more effective than C as a reducing agent below $710^{\circ}C$

C. ΔG° of metal oxides is higher than that of CO_2

hence oxidation of metal sulphides to oxides is not favourable.

D. Need for conversion of metal sulphide to metal oxide

before reduction can be explained

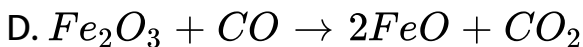
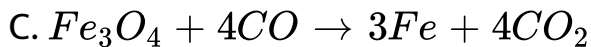
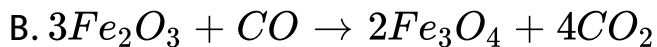
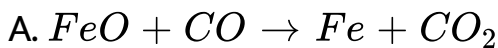
thermodynamically.

Answer: C

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48. Write down the reactions taking place in Blast furnace related to the metallurgy of iron in the temperature range

500 – 800K

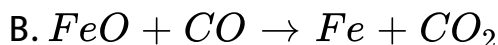
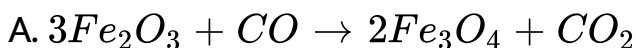


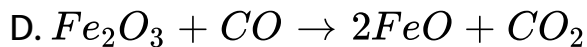
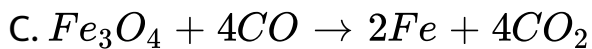
Answer: A



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49. Which of the following reactions takes place at higher temperature range (900 K-1500 K) in blast furnace ?





Answer: B



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50. In the manufacture of iron from hematite, limestone is added to act as _____.

A. Flux

B. slag

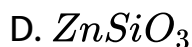
C. reducing agent

D. gangue

Answer: A

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51. The main reactions occurring in blast furnace during extraction of iron from haematite ore.....



Answer: A

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52. The materials which can withstand very high temperature without melting or becoming soft are called..... . These are used in makingof furnaces.

A. refractory materials, inner lining

B. flux, base

C. brick materials , outer structure

D. mica, outer lining.

Answer: A



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53. How is cast iron different from pig iron ?

A. cast iron is purest form of iron while pig iron is impure

B. cast iron has lower carbon content (3%) as compared to pig iron (4%) and is extremely hard and brittle.

C. pig iron contains many impurities like S, P, Si and Mn while cast iron does not contain any impurity and can be casted into any shape

D. Cast iron is soft and malleable while pig iron heating it with

Answer: B



54. Impurities present in wrought iron ?

A. C

B. $CaCO_3$

C. Fe_2O_3

D. SiO_2

Answer: C

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55. In blast furnace, iron oxide is reduced by

A. silica

B. carbon monoxide

C. carbon

D. lime stone.

Answer: B



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56. Blister copper obtained during extraction from cuprous oxide is called so because

A. it has blister like eruptions due to evolution of gas.

B. it has a shining surface like blister

C. it is the most impure form of copper

D. its surface is uneven due to different thickness at different places.

Answer: A



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

A. 1. Auto-reduction of Cu_2O formed is carried out by remaining Cu_2S in the reaction.

B. 2. Cu is separated out by partial reduction due to sedimentation

C. 3. Due to difference in gravity Cu_2O and Cu_2S are separated.

D. 4. Complete roasting cannot be done in one step hence partial roasting is done.

Answer: A

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58. Silica is added to the sulphide ore of copper in reverberatory furnace because

- A. 1. sulphide ore of copper contains iron as impurity which is removed as iron slag.
- B. 2. silica reacts with Cu_2O to form slag
- C. 3. silica helps in reduction of Cu_2O to Cu
- D. 4. sulphide ore of copper is separated from iron by reacting with silica.

Answer: A

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59. Blister copper is

- A. 1. impure copper

- B. 2. obtained in self-reduction process during bessemerisation
- C. 3. both are correct
- D. 4. none is correct

Answer: C

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60. From the Ellingham graph between Gibbs energy and temperature, out of C and CO which is a better reducing agent for ZnO ?

- A. Carbon
- B. CO

C. Both of these

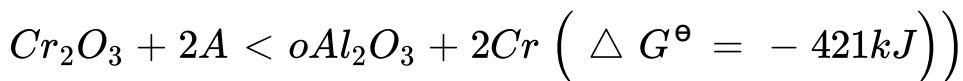
D. None of these

Answer: A



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61. The reaction



Is thermodynamically feasible as is apparent from the Gibbs energy value. Why does it not take place at room temperature?

A. Certain amount of activation energy is essential for thermodynamically feasible reactions also.

B. Due to high melting point of chromium oxide the reaction does not take place.

C. Overall value of ΔG for the net reaction becomes positive.

D. Molecules of Cr_2O_3 and Al are not oriented properly.

Answer: A

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62. In the thermite process, ____ is used as a reducing agent.

A. Zn

B. Al

C. Mn

D. Fe

Answer: B



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63. The metallurgical process in which a metal is obtained in a fused state is called

A. an oxidising agent

B. a reducing agent

C. acidic flux

D. basic flux

Answer: B

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64. The metal that cannot be produced on reduction of its oxide by aluminium is :-

A. Cr

B. Mn

C. Fe

D. Mg

Answer: D

65. Mark the incorrect statement.

- A. Copper is extracted by smelting in a reverberatory furnace.
- B. Zinc is extracted by reduction of oxide with aluminium .
- C. Aluminium is extracted by electrolysis of its oxide.
- D. Iron is extracted by reduction of its oxide in blast furnace.

Answer: B

66. Match the column I with Column II to match the method of extraction and mark the appropriate choice.

Column I		Column II	
(A)	Cu	(i)	Direct reduction of sulphide by heating
(B)	Sn	(ii)	Electrolysis of fused chloride and fluoride
(C)	Hg	(iii)	Partial oxidation of sulphide ore
(D)	Ca	(iv)	Reduction of oxide with carbon

A. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (ii)

C. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)

D. (A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iii)

Answer: B



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

A. Fe

B. Cu

C. Ag

D. Al

Answer: D



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68. Write chemical reactions taking place in the extraction of Aluminium from Bauxite ore .

A. The concentration of ore is done by gravity separation method.

B. molten mixture of aluminium oxide, cryolite or fluorspar is electrolysed

C. impure aluminium is refined by liquation

D. molten aluminium is obtained at cathode while fluorine is liberated at anode.

Answer: B



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69. Cryolite and fluorspar are mixed with Al_2O_3 during electrolysis for extraction of aluminium to

- A. increase the mass of the reaction mixture
- B. get other products at anode like fluorine
- C. lower the melting point and increase the conductivity of the electrolyte
- D. reduce aluminium oxide by cryolite

Answer: C



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70. In electrometallurgy of aluminium , what will happen if graphite rodes are not used as anode and are replaced by some other metal ?

- A. O_2 liberated at node will react with aluminium to give back Al_2O_3
- B. F_2 will be liberated at anode instead of O_2
- C. The process of electrometallurgy will become non-spontaneous
- D. Aluminium oxide splits into Al^{3+} and O^{2-} ions only in presence of graphite

Answer: A



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71. Out of the following metals that cannot be obtained by electrolysis of the aqueous solution of their salts is

A. Cr

B. Na

C. Ca

D. Mg

Answer: A



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72. Which of the following statements is correct ?

(i) Copper is extracted by hydrometallurgy from low grade ores.

(ii) In electrolytic reduction of alumina , graphite is acting as anode and steel vessel with lining of carbon acts as cathode.

(iii) In Hall-Heroult process, aluminium is obtained at anode and CO and CO_2 are produce at cathode

A. (i) only

B. (i) and (ii) only

C. (ii) and (iii) only

D. All of these

Answer: B



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73. In the extraction of chlorine from brine _____

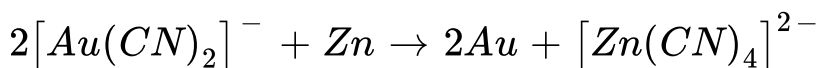
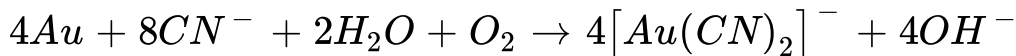
- A. reduction
- B. displacement
- C. oxidation
- D. evaporation

Answer: C



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74. Following reactions take place during extraction of gold



Zinc in the extraction of gold acts as a/an

- A. oxidising agent
- B. flux
- C. reducing agent
- D. decomposing agent

Answer: C



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

A. Al

B. Zn

C. Cu

D. Mg

Answer: A

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76. Which of the following is not a refining process?

A. Electrolysis

B. Smelting

C. Poling

D. Liquation

Answer: B



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77. In this method, a low melting metal like tin can be made to flow on a sloping surface. In this way it is separated from higher melting impurities. This method is known as

A. distillation

B. vapour phase refining

C. liquation

D. zone refining

Answer: C

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78. Most electropositive metal are obtained from their ores
by

- A. autoreduction
- B. smelting with carbon
- C. electrolysis of fused salts
- D. thermal decomposition

Answer: C

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79. Which one of the following is true in electrolytic refining ?

- A. Impure metal is made cathode
- B. Impure metal is made anode
- C. Impure metal is made cathode and pure metal as anode
- D. Both electrodes must be of pure metal.

Answer: B

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80. Carnallite on electrolysis gives

A. Mg and Cl_2

B. Ca and Cl_2

C. K and Cl_2

D. Al and Cl_2

Answer: C



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81. In electrorefining of copper, some gold is deposited as

A. cathode mud

B. electrolyte

C. anode mud

D. cathode

Answer: C



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82. During the process of electrolytic refining of copper some metals present as impurity settle as 'anode mud'.

These are

A. Sn and Ag

B. Pb and Zn

C. Ag and Au

D. Fe and Ni

Answer: C

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83. Which of the following is used as a method purification for silicon ?

A. Electrolytic refining

B. Liquation

C. Zone refining

D. Distillation

Answer: C

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84. Which of the following are main requirements for vapour phase refining ?

(i) Metal should form a volatile compound with the reagent

(ii) The volatile compound should be easily decomposable to give back pure metal

(iii) Metal should be very reactive and form a stable compound with the reagent

A. (i), (ii) and (iii)

B. (i) and (ii)

C. (ii) and (iii)

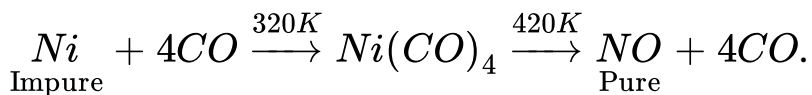
D. (i) and (iii)

Answer: B



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85. (xiv) Following equation represents a method of purification of nickel by



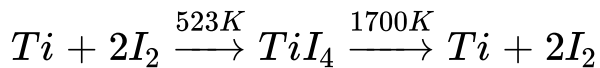
- A. van Arkel process
- B. pyrometallurgy
- C. Mond process
- D. zone refining

Answer: C



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86. Which method of purification is represented by the following equations



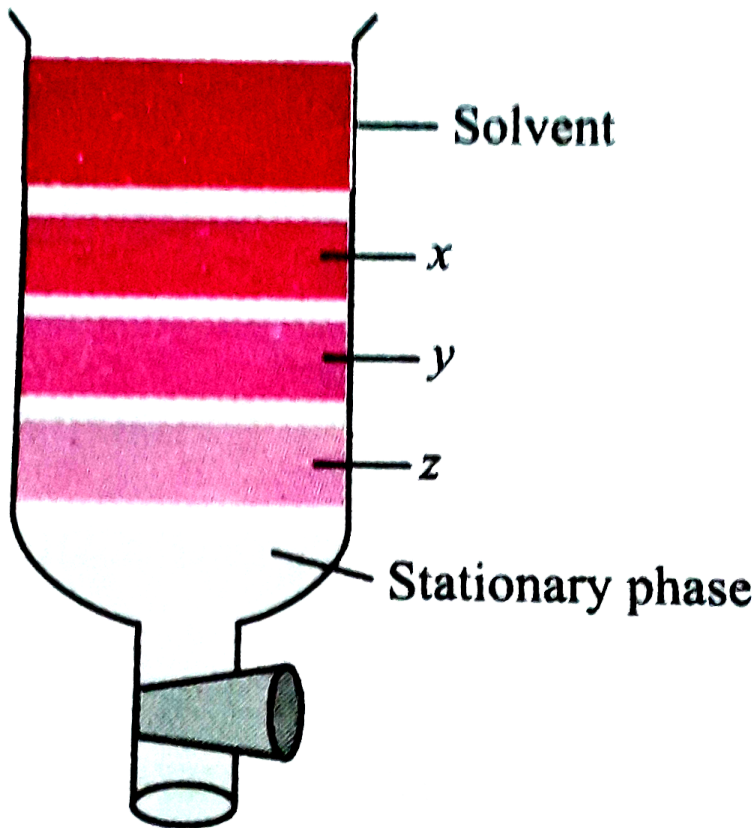
- A. Zone refining
- B. Mond's process
- C. Cupellation
- D. van Arkel process

Answer: D



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87. Column chromatography involves separation of a mixture over a column of adsorbent (stationary phase) packed in a glass tube. Depending upon the degree of adsorption complete separation takes place. In the given column, three coloured bands x, y, z are formed. Identify the correct statement.



A. x,y and z are absorbed to the same extent.

B. The most readily adsorbed component is retained near the top(x)

C. The most readily adsorbed component comes down (z).

D. x, y, z layers are formed according to the wavelengths of the colours not on the basis of adsorption.

Answer: B

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88. During a column chromatography through Al_2O_3 column, a mixture of components A,B and C is passed

through the column. On adding eluant, compound 'A' is eluted first then 'B' and in the end 'C'. Which of the following statements regarding the components is correct ?

A. The order of adsorption of A, B and C is $C > B > A$

B. The order of adsorption of A,B and C is $A > B > C$

C. The order of adsorption of A,B and C is $B > A > C$

D. The order of adsorption of A, B and C is $B > C > A$

Answer: A

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89. Chromatography is used for the purification of

- A. very reactive
- B. available in minute quantities
- C. present in abundance
- D. highly electropositive

Answer: B

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90. The mineral carnallite contains (i) ("_____") and (ii) ("_____") metals.

(iii) ("_____") is purified by cupellation and (iv) ("_____") is purified by distillation .

- A. (i) calcium (ii) zinc (iii) mercury (iv) tin

- B. (i) calcium (ii) magnesium (iii) zinc (iv) lead
- C. (i) potassium (ii) calcium (iii) copper (iv) mercury
- D. (i) magnesium (ii) potassium (iii) silver (iv) mercury

Answer: D

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91. Mark the correct statements.

- (i) Mercury can be refined by the process of distillation.
- (ii) In poling, the molten impure metal is stirred with green poles of wood.
- (iii) In electrolytic refining of metals , impure metal is made as cathode and a thin strip of pure metal is made as anode.

- A. (i) and (ii)
- B. (i) and (iii)
- C. (ii) and (iii)
- D. (i), (ii) and (iii)

Answer: A

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92. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	van Arkel method	(i)	Ni
(B)	Zone refining	(ii)	Ti
(C)	Mond process	(iii)	Ag
(D)	Cupellation	(iv)	Ge

A. $(A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)$

B. $(A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iv)$

C. $(A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)$

D. $(A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)$

Answer: C



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93. Which of the following statements is not correct ?

A. Zinc can be extracted from its ore by roasting followed by reduction with coke.

B. In reverberatory furnace , both oxidation and reduction processes can be carried out.

C. Silver is purified by distillation or liquation process.

D. Highly pure metals are obtained by zone refining.

Answer: C



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94. Find the incorrect match.

A. Fine dust of aluminium - Paints and Lacquers

B. Reducing agent in the manufacture of dye-stuffs, paints etc.-Copper dust

C. For cutting tools and crushing machines -Chorme
steel

D. For making cables, automobiles and aeroplane parts -
Nickel steel

Answer: B

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95. _____ and _____ are alloys of copper.

A. Brass and Bronze

B. Brass and alloy steel

C. Copper pyrites and malachite

D. Copper glance and cuprite

Answer: A

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96. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Electrical industry	(i)	Zinc
(B)	Batteries	(ii)	Steel
(C)	Gutter pipes	(iii)	Copper
(D)	Gas stoves	(iv)	Cast iron

A. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (iv), (D) \rightarrow (i)

C. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

D. $(A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (ii)$

Answer: D

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Hots

1. Roasting of ores is done in

A. to burn off sulphur, arsenic, antimony etc. as oxides

and convert all the iron and copper to their oxides

B. to burn off arsenic, antimony etc. as oxides and burn

off sulphur so that enough of it remains to combine

with all the copper.

C. to burn off sulphur partially, in order to leave enough of sulphur to combine with arsenic, antimony etc. and to convert all the iron and copper to oxides.

D. to melt arsenic and antimony sulphides etc. and remove them by liquation and to burn off sulphur partially to leave enough to combine with copper and iron.

Answer: C

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

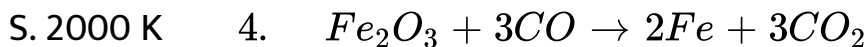
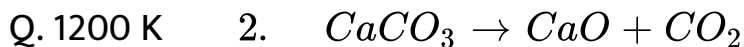
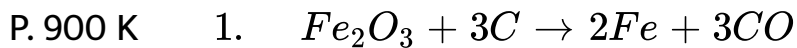
- A. The ΔG_f° of the sulphide is greater than those for CS_2 and H_2S
- B. The ΔG_F° is negative for roasting of sulphide ore to oxide.
- C. Roasting of the sulphide to the oxide is thermodynamically feasible.
- D. Carbon and hydrogen are suitable reducing agents for metal sulphides.

Answer: D



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3. Given below are the different temperature reactions and products during extraction of iron in blast furnace.



Find the correct match.

A. P-4,Q-2,R-3,S-1

B. P-4,Q-3,R-2,S-1

C. P-3,Q-4,R-1,S-2

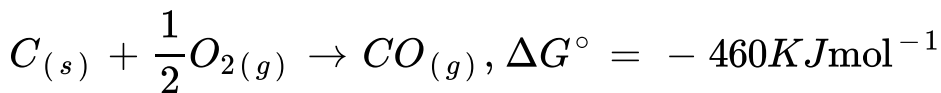
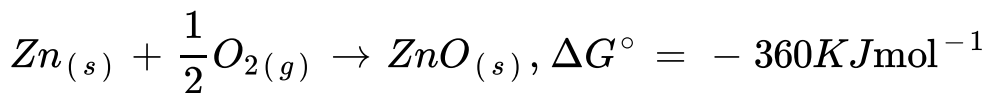
D. P-4,Q-2,R-1,S-3

Answer: D



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4. At 1000°C ,



The correct statement is

- A. zinc can be oxidised by carbon monoxide
- B. zinc blend is produced during the reaction
- C. zinc oxide can be reduced by graphite
- D. zinc can be oxidised by graphite

Answer: C



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5. Consider the following statements :

S_1 : In extraction of iron from haematite ore, the reduction reactions take place only in the lower temperature range in the blast furnace.

S_2 : Calamine is a carbonate ore of zinc.

S_3 : The principal ore of aluminium, bauxite, usually contains silica, iron oxides and titanium oxide as impurities.

S_4 : Solidified copper obtained from a silica-lined converter (Bessemer converter) has a blistered appearance due to the evolution of SO_2 .

Which are the correct statements?

A. I and II

B. II and III

C. I and III

D. II, III and IV

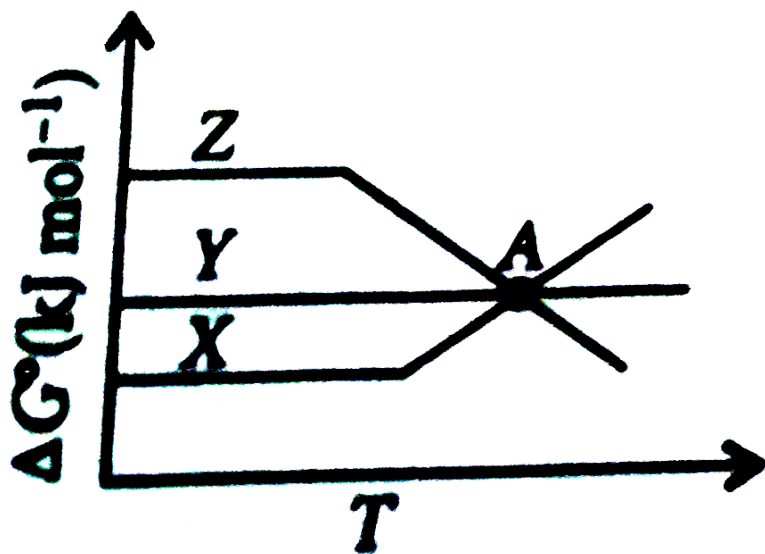
Answer: C



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6. In the following Ellingham diagram ,X, Y and Z represent graphs for metal oxides . Select the correct option before

point A.



- A. Y will reduce oxide of Z
- B. Y will reduce oxide of X.
- C. Z will reduce oxide of Y
- D. Z will reduce oxide of Y

Answer: A



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7. Four metals and their methods of refinement are given

(i) *Ni, Cu, Zr, Ga*

(ii) Electrolysis, Val Arkel process, zone refining, Mond's process

Choose the right method for each :

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

Zr : Zone refining, Ga: Mond's process

B. Ni: Mond's refining ,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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Ncert 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: A

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

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

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

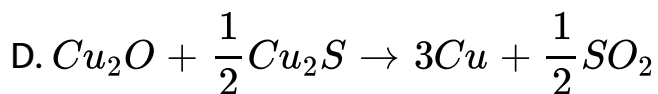
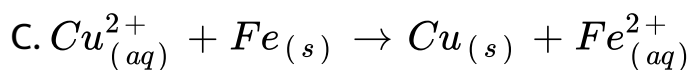
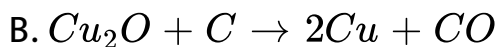
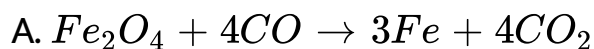
C. sulphides of copper (I) and iron (II)

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

Answer: C

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



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 in pure metal

Answer: B



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

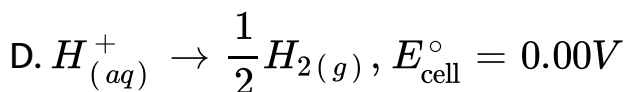
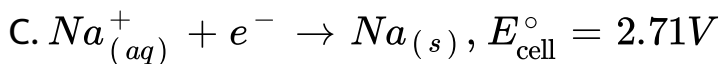
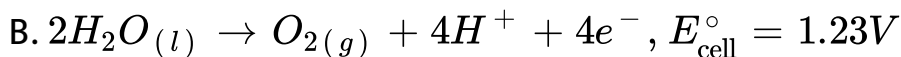
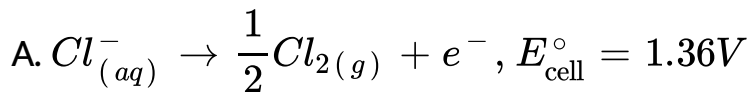
- A. FeS
- B. CO
- C. Cu_2S
- D. SO_2

Answer: C



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



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 change 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. displacemtn of metal by some other metal from the complex ion

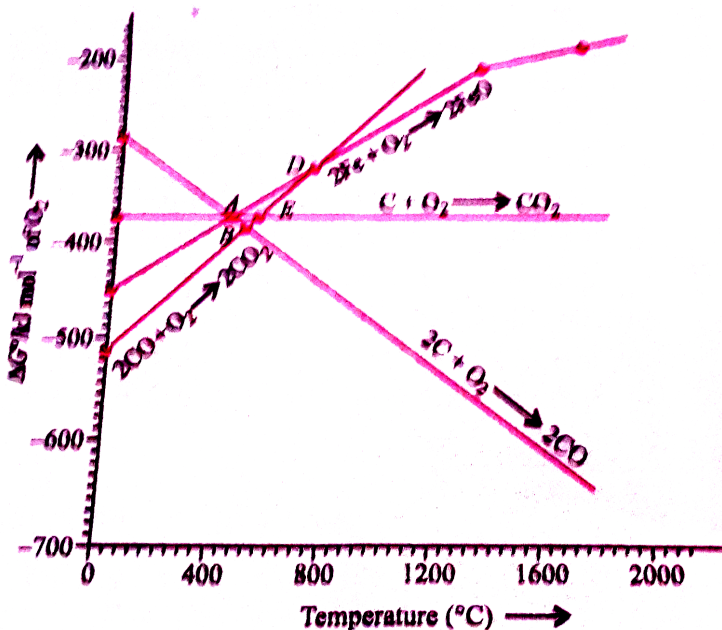
B. roasting of metal complex

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

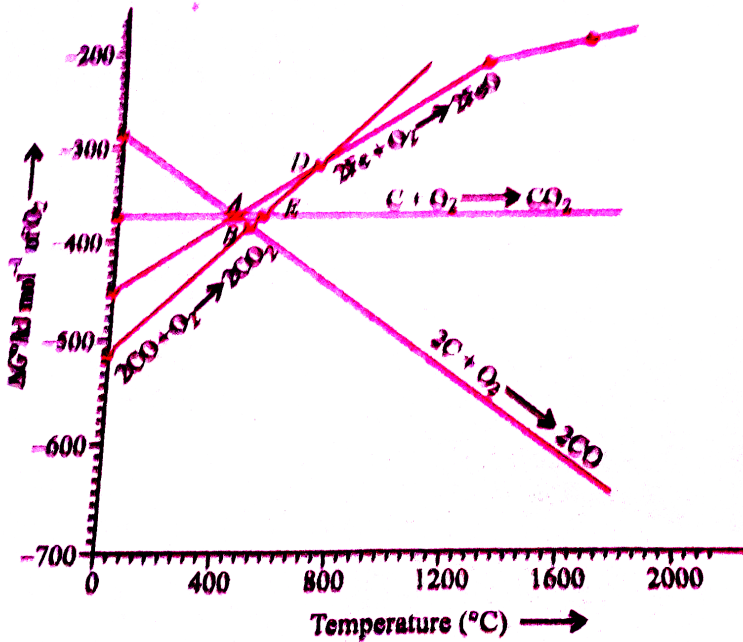
C. Above temperature at point A but below temperature at point D

D. Above temperature at point A

Answer: D



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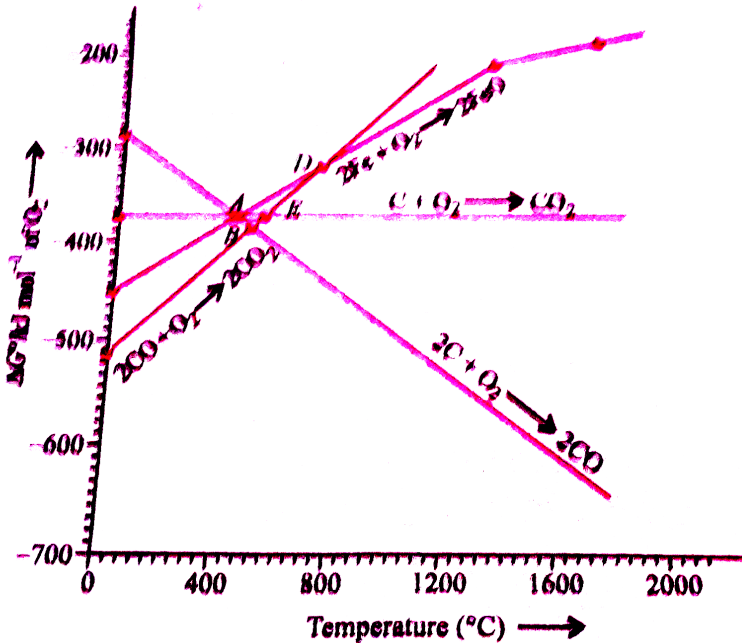
12.

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. 1. ΔG° value for the overall reduction with carbon monoxide is zero.

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

C. 3. ΔG° value for the overall reduction reaction with a mixture of 2 mol carbon and 1 mol oxygen will be positive.

D. 4. ΔG° value for the overall reduction reaction with carbon monoxide is negative

Answer: A



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Assertion Reason

1. Assertion : Minerals are naturally occurring chemical substances in the earth's crust obtainable by mining.

Reason : Minerals are also known as ores.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C



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2. Assertion : In froth floatation method, collectors such as pine oil or xanthates are added to the suspension of powdered ore.

Reason : Collectors stabilise the froth.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C



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3. Assertion : Gold and silver are extracted from their native ores by leaching.

Reason : Both silver and gold particles dissolve in dilute solution of sodium cyanide in presence of oxygen.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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4. Assertion: Roasting is a process in which the ore is heated in presence of air Reason: Concentration of sulphide ore is done by calcination

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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5. Assertion : Reduction of a metal oxide is easier if the metal formed is in liquid state at the temperature of reduction. Reason : The entropy is higher if the metal is in liquid state.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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6. Assertion : Sulphide ores are converted to oxides before reduction.

Reason : Oxides are easier to reduce.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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7. Assertion : Magnesium metal is not used for the reduction of alumina in the metallurgy of aluminium.

Reason : MgO curve lies above Al_2O_3 curve in Ellingham diagram.

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

- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C

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8. Assertion : In the metallurgy of aluminium , purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2 .

Reason : Na_3AlF_6 or CaF_2 lowers the melting point of mixture and increases its conductivity.

- A. 1. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. 2. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. 3. If assertion is true but reason is false
- D. 4. If both assertion and reason are false.

Answer: A

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9. Assertion: Limestone added in the blast furnace decomposes to give CaO which forms slag in molten state and separates out from iron

Reason : The iron obtained from the blast furnace contains about 4% carbon and many impurities like S,P,Si, Mn, etc.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: B



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10. Assertion : Tin is refined by liquation method.

Reason : Tin has low melting point as compared to impurities .

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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11. Assertion : In electrolytic refining of metal, impure metal is made cathode while a strip of pure metal is used as anode.

Reason : The pure metal gets deposited at anode as anode mud.

- A. 1. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. 2. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. 3. If assertion is true but reason is false
- D. 4. If both assertion and reason are false.

Answer: D



12. Assertion: Zone refining method is used to produce pure metals which are used as semiconductors.

Reason: Semiconductors are used in highly pure form.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: B



13. Assertion: Nickel is purified by reaction it with CO .

Reason: Impurities present in nickel form volatile compounds.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C



14. Assertion : van Arkel method is used for refining of Zinc.

Reason : In this method impure is evaporated to obtain the pure metal as distillate .

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D



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15. Assertion : Chromatography in general involves a mobile (a gas, a liquid or a supercritical fluid) and a stationary phase (like Al_2O_3 column).

Reason : A component which is less soluble in stationary phase takes longer time to travel through it than the component which is more soluble in stationary phase.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C

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Occurrence Of Metals

1. Which of the following examples is not correctly matched ?

- A. (A) Two most abundant elements -Fe, Al.
- B. (B) Two metals which occur in native state -Au, Pt.
- C. (C) Two metals which can occur in combined and native state both -Zn, Fe
- D. (D) None of these

Answer: C

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2. Which of the following is not the correct name of the formula of the ore given with it ?

A. $MgSO_4 \cdot 7H_2O$ - Epsom salt

B. $CuCO_3 \cdot CU(OH)_2$ -Malachite

C. $KAlSi_3O_8$ -Feldspar

D. $KCl \cdot MgCl_2 \cdot 6H_2O$ Dolomite

Answer: D

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3. In which of the following the name of the ore is not matched with its formula ?

A. Cassiterite - SnO_2

B. Limonite - $Fe_2O_3 \cdot 3H_2O$

C. Siderite - $FeCO_3$

D. Anglesite - $PbCO_3$

Answer: D



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4. Pyrolusite is

A. a sulphide ore of Mn

B. an oxide ore of Mn

C. a carbide ore of P

D. a chloride ore of Zn.

Answer: B



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5. The metal which can be extracted from the bauxite ore is:

A. Malachite -Cu

B. Calamine-Zn

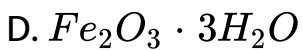
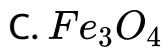
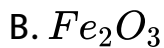
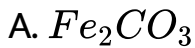
C. Chromite -Cr

D. Dolomite -Al

Answer: D

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6. Which of the following is magnetite ?



Answer: C

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

A. Carnallite

B. Magnesite

C. Dolomite

D. Gypsum

Answer: D

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8. Which of the following is not an ore?

A. Corundum

B. Zincite

C. Calamine

D. Chromite

Answer: C



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9. Which one of the following is not a sulphide ore ?

A. Galena

B. Iron pyrites

C. Magnetite

D. Copper glance

Answer: C

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10. An example of halide ore is

A. Cassiterite

B. Anglesite

C. Siderite

D. Carnallite

Answer: D

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11. Which of the following is not a carbonate ore?

A. Dolomite

B. Calamine

C. Siderite

D. Zincite

Answer: D



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12. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Calamine	(i)	Calcium
(B)	Barytes	(ii)	Barium
(C)	Cinnabar	(iii)	Zinc
(D)	Limestone	(iv)	Mercury

A. $(A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)$

B. $(A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (iv), (D) \rightarrow (i)$

C. $(A) \rightarrow (i), (B) \rightarrow (iv), (C) \rightarrow (ii), (D) \rightarrow (iii)$

D. $(A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (iv)$

Answer: B



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13. Find the incorrect match.

A. Kaolinite – $[Al_2(OH)_4Si_2O_5]$

B. Siderite – Fe_2O_3

C. Sphalerite – ZnS

D. Magnetite – Fe_3O_4

Answer: B



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Concentration Of Ores

1. Removal of the unwanted materials from the ore is known as

A. concentration , dressing , benefaction

B. separation , refining , gangue

C. magnetic separation, purification, gangue

D. washing, refining, amalgamation

Answer: A



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2. The powdered ore is agitated with water or washed with running stream of water. The heavy ore particles and lighter impurities are separated . This method of concentration is known as

A. metallurgy

B. leaching

C. gravity separation

D. froth floatation process.

Answer: C



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3. Which one of the following scrap metal cannot be separated by magnetic separation ?

A. (A)Haematite

B. (B)Malachite

C. (C)Magnetite

D. (D)Siderite

Answer: B

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4. An ore of tin containing $FeCrO_4$ is concentrated by _____.

- A. gravity separation
- B. magnetic separation
- C. froth floatation
- D. leaching

Answer: B

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5. Sulphide ore of copper can be concentrated by

- A. (A)Forth flotation process
- B. (B)electromagnetic process
- C. (C)gravity separation
- D. (D)distillation

Answer: A



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6. For which ore of the metal, froth floatation method is used for concentration?

- A. Haematite

B. Zinc blende

C. Magnetite

D. Carnallite

Answer: B



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7. Which of the following statements is correct about the role of substances added in the froth floatation process?

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

B. Collectors enhance the wettability of gangue particles.

C. Collectors help in separating two sulphide ores present in the mixture.

D. Collectors helps ore particles to settle down below the froth .

Answer: A

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8. Froth floatation process is used to concentrate:

- A. preferential wetting properties with the frothing agent and water.
- B. difference in the specific gravities of gangue and ore particles.
- C. difference in solubility of gangue and ore particles in frothing agent and water
- D. difference in reactivity of gangue and ore particles with water and frothing agent.

Answer: A



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

A. coconut oil

B. cartor oil

C. plamitic oil

D. pine oil.

Answer: D



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10. How do we separate two sulphide ores by froth floatation method?

A. by using excess of pine oil

B. by adjusting proportion of oil to water or using depressant .

C. By using collectors and froth stabilisers like xanthates.

D. By using some solvent in which one of the sulphides is soluble.

Answer: B

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11. Sometimes, it is possible to separate two sulphide ores by adjusting proportion of oil to water or by using

depressants. In case of an ore containing ZnS and PbS, the depressant used is

- A. NaCN prevents PbS from coming to the froth but allows ZnS to come with froth .
- B. NaCN prevents ZnS from coming to the froth but allows PbS to come with froth.
- C. NaCN prevents frothing of both ZnS and PbS, hence no froth is formed.
- D. NaCN does not act as depressant hence a mixture of PbS and ZnS is found in froth.

Answer: B



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12. the common impurities present in bauxite are

A. CuO

B. ZnO

C. CaO

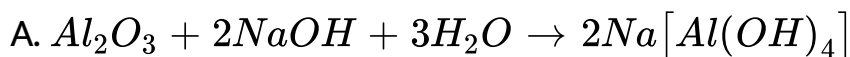
D. SiO_2

Answer: D

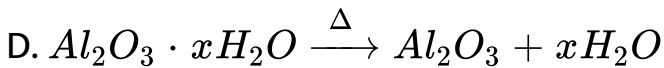
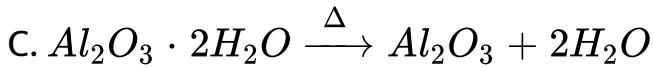
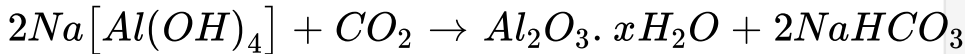


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13. Which of the following reactions does not take place during leaching for concentration of bauxite ?



B.



Answer: C



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14. The significance of leaching in the extraction of aluminum is

A. it helps removing the impurities like SiO_2 , Fe_2O_3 ,
etc from the bauxite ore

- B. it converts the ore into oxide
- C. it reduces the melting point of the ore
- D. it eliminates water from bauxite.

Answer: A

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15. Which one of the following ores is treated by chemical leaching

- A. Cinnabar
- B. Argentite
- C. Copper pyrites

D. Galena

Answer: B

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16. Which of the following metals is not extracted by leaching ?

A. Aluminium

B. Mercury

C. Silver

D. Gold

Answer: B

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

- A. Leaching is carried out with NaOH and O_2
- B. Leaching is carried out with NaCN.
- C. Leaching is carried out with acids in presence of H_2 .
- D. Leaching is carried out by boiling the ore with water.

Answer: C

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1. Which of the following changes take place during roasting ?

(i) Impurities are removed as they form volatile oxides.

(ii) Ore is converted into their volatile oxides.

(iii) Changes like oxidation , chlorination, etc. take place

A. (i) and (ii)

B. (ii) and (iii)

C. (i) and (iii)

D. (i), (ii) and (iii)

Answer: D



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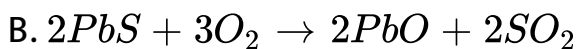
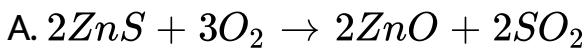
2. Heating pyrites to remove sulphur is called

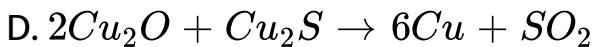
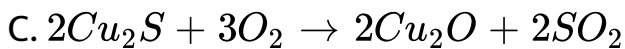
- A. smelting
- B. calcination
- C. liquation
- D. roasting

Answer: D

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3. Which of the following is not an example of roasting ?





Answer: D



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4. Fill in the blanks with the correct choice.

The undesired impurities present in the ores are called

____ (i) ____ . To remove the volatile impurities from the ore, the

____ (ii) ____ process is carried out. Flux combines with non-fusible

impurities to form ____ (iii) ____ . CaO acts as a ____ (iv) ____ flux.

A. gangue roasting slag acidic

B. gangue calcination slag basic

C. anode mud leaching matrix acidic

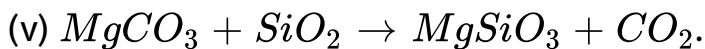
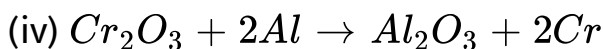
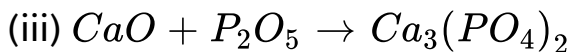
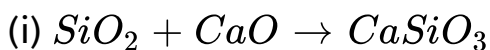
D. gangue roasting solution acidic

Answer: B



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5. How many reactions can show slag formation process from the given reaction ?



A. (i) SiO_2 - Acidic flux (ii) MgO — Basic flux

B. (i) SiO_2 - Basic flux (ii) MgO - Acidic flux

C. (i) SiO_2 - Basic flux (ii) MgO -Basic flux

D. (i) SiO_2 -Acidic flux (ii) MgO -Acidic flux

Answer: A



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6. Explain the following

(i) Chalcocite is roasted and not calcined during recovery of copper.

(ii) Magnesium oxide is used for lining in steel making furnace

- A. MgO acts as an acidic flux to remove impurities of Si, P and S
- B. MgO acts as a basic flux to remove impurities of Si P and S
- C. MgO acts as an oxidising agent to removing impurities of oxides
- D. MgO does not react with any type of impurities

Answer: B

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7. Which of the following metals is extracted using silica lined convertor ?

A. Mg

B. Al

C. Cu

D. Zn

Answer: C



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8. 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?

A. carbon which reduce the impurities

B. water which dissolves the impurities

C. limestone which changes impurities into oxides and pass into slag

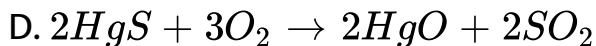
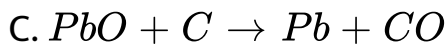
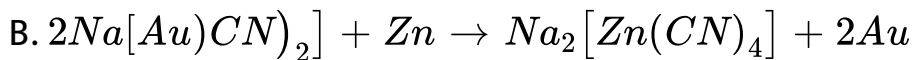
D. iron oxide which reacts with impurities by forming slag.

Answer: C

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9. Which of the following reactions show the process of smelting ?

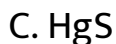




Answer: C

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10. Which of the following sulphides when heated without undergoing separated reduction of oxide ?



D. ZnS

Answer: C

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11. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Calcination	(i)	$\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Cr} + \text{Al}_2\text{O}_3$
(B)	Roasting	(ii)	$\text{FeCO}_3 \rightarrow \text{FeO} + \text{CO}_2$
(C)	Smelting	(iii)	$2\text{ZnS} + 3\text{O}_2 \rightarrow \text{ZnO} + 2\text{SO}_2$
(D)	Aluminothermy	(iv)	$\text{PbO} + \text{C} \rightarrow \text{Pb} + \text{CO}$

A. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. $(A) \rightarrow (iv)$, $(B) \rightarrow (iii)$, $(C) \rightarrow (ii)$, $(D) \rightarrow (i)$

C. $(A) \rightarrow (iii)$, $(B) \rightarrow (ii)$, $(C) \rightarrow (i)$, $(D) \rightarrow (iv)$

D. $(A) \rightarrow (ii)$, $(B) \rightarrow (iii)$, $(C) \rightarrow (iv)$, $(D) \rightarrow (i)$

Answer: D



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Thermodynamic Principle Of Metallurgy

1. Ellingham diagram represents:

A. ΔG with temperature

B. ΔH with temperature

C. ΔH with pressure

D. ($\Delta G - T\Delta S$) with temperature

Answer: A

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2. Which of the following statements is correct according to the basic concepts of thermodynamics which govern the feasibility of a metallurgical process ?

A. When the value of ΔG is positive for the equation

$\Delta G = \Delta H - T\Delta S$, the reaction will proceed.

B. If reactant and products of two reactions are put

together and net ΔG is -ve , the overall reaction with

occur.

C. On increasing the temperature , the value of ΔG reaction will occur.

D. Feasibility of thermal oxidation of an ore can be established by Ellingham diagram in which a straight line shows the reduction will proceed.

Answer: B

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

A. Sulphides cannot be reduced easily while oxides can be reduced easily.

B. Sulphides decompose on reduction hence they are first converted to oxides

C. Sulphides ore have higher melting points than oxides.

D. Oxides are more stable than sulphides hence easy to reduce.

Answer: A



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4. The metal oxide reacts with a _____. The oxide is _____ to metal and reducing agent is _____. Net Gibbs energy change is _____.

- A. a. reducing agent, oxidised, reduced, negative
- B. b. reducing agent, reduced, oxidised, negative
- C. c. oxidising agent, reduced, oxidised, positive
- D. d. reducing agent, reduced, oxidised, positive.

Answer: B



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5. Which of the following is not correct observation on Ellingham diagram ?

A. A metal can reduce the oxide of other metal which lies below it in Ellingham diagram .

B. CO is more effective than C as a reducing agent below $710^{\circ}C$

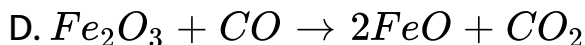
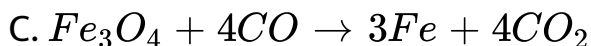
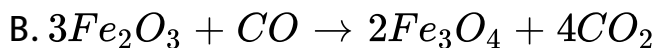
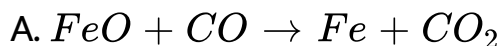
C. ΔG° of metal oxides is higher than that of CO_2 hence oxidation of metal sulphides to oxides is not favourable.

D. Need for conversion of metal sulphide to metal oxide before reduction can be explained thermodynamically.

Answer: C

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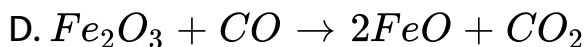
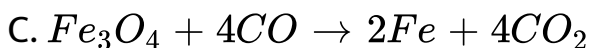
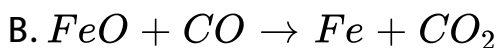
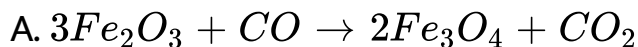
6. Write down the reactions taking place in Blast furnace related to the metallurgy of iron in the temperature range $500 - 800K$



Answer: A

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7. Which of the following reactions takes place at higher temperature range (900 K-1500 K) in blast furnace ?



Answer: B



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8. In the manufacture of iron from hematite, limestone is added to act as _____.

A. Flux

B. slag

C. reducing agent

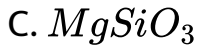
D. gangue

Answer: A



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9. The main reactions occurring in blast furnace during extraction of iron from haematite ore.....



Answer: A



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10. The materials which can withstand very high temperature without melting or becoming soft are called..... . These are used in makingof furnaces.

A. refractory materials, inner lining

B. flux, base

C. brick materials , outer structure

D. mica, outer lining.

Answer: A



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11. How is cast iron different from pig iron ?

A. cast iron is purest form of iron while pig iron is impure

B. cast iron has lower carbon content (3%) as compared to pig iron (4%) and is extremely hard and brittle.

C. pig iron contains many impurities like S, P, Si and Mn while cast iron does not contain any impurity and can be casted into any shape

D. Cast iron is soft and malleable while pig iron heating it with

Answer: B

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12. Impurities present in wrought iron ?

A. C

B. $CaCO_3$

C. Fe_2O_3

D. SiO_2

Answer: C



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13. In blast furnace, iron oxide is reduced by

A. silica

B. carbon monoxide

C. carbon

D. lime stone.

Answer: B



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14. Blister copper obtained during extraction from cuprous oxide is called so because

- A. it has blister like eruptions due to evolution of gas.
- B. it has a shining surface like blister
- C. it is the most impure form of copper
- D. its surface is uneven due to different thickness at different places.

Answer: A



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

A. 1. Auto-reduction of Cu_2O formed is carried out by remaining Cu_2S in the reaction.

B. 2. Cu is separated out by partial reduction due to sedimentation

C. 3. Due to difference in gravity Cu_2O and Cu_2S are separated.

D. 4. Complete roasting cannot be done in one step hence partial roasting is done.

Answer: A



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16. Silica is added to the sulphide ore of copper in reverberatory furnace because

A. 1. sulphide ore of copper contains iron as impurity which is removed as iron slag.

B. 2. silica reacts with Cu_2O to form slag

C. 3. silica helps in reduction of Cu_2O to Cu

D. 4. sulphide ore of copper is separated from iron by reacting with silica.

Answer: A



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17. Blister copper is

A. 1. impure copper

B. 2. obtained in self-reduction process during
bessemerisation

C. 3. both are correct

D. 4. none is correct

Answer: C



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18. From the Ellingham graph between Gibbs energy and temperature, out of C and CO which is a better reducing

agent for ZnO ?

A. Carbon

B. CO

C. Both of these

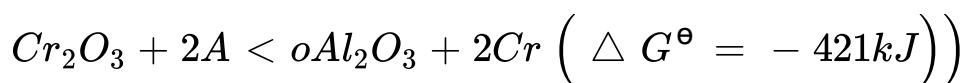
D. None of these

Answer: A



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19. The reaction



Is thermodynamically feasible as is apparent from the

Gibbs energy value. Why does it not take place at room temperature?

- A. Certain amount of activation energy is essential for thermodynamically feasible reactions also.
- B. Due to high melting point of chromium oxide the reaction does not take place.
- C. Overall value of ΔG for the net reaction becomes positive.
- D. Molecules of Cr_2O_3 and Al are not oriented properly.

Answer: A



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20. In the thermite process, _____ is used as a reducing agent.

A. Zn

B. Al

C. Mn

D. Fe

Answer: B

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21. The metallurgical process in which a metal is obtained in a fused state is called

A. an oxidising agent

B. a reducing agent

C. acidic flux

D. basic flux

Answer: B



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22. The metal that cannot be produced on reduction of its oxide by aluminium is :-

A. Cr

B. Mn

C. Fe

D. Mg

Answer: D

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23. Mark the incorrect statement.

- A. Copper is extracted by smelting in a reverberatory furnace.
- B. Zinc is extracted by reduction of oxide with aluminium .
- C. Aluminium is extracted by electrolysis of its oxide.

D. Iron is extracted by reduction of its oxide in blast furnace.

Answer: B

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Electrochemical Principle Of Metallurgy

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

A. Fe

B. Cu

C. Ag

D. Al

Answer: D

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2. Write chemical reactions taking place in the extraction of Aluminium from Bauxite ore .

A. The concentration of ore is done by gravity separation method.

B. molten mixture of aluminium oxide, cryolite or fluorspar is electrolysed

C. impure aluminium is refined by liquation

D. molten aluminium is obtained at cathode while fluorine is liberated at anode.

Answer: B

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3. Cryolite and fluorspar are mixed with Al_2O_3 during electrolysis for extraction of aluminium to

A. increase the mass of the reaction mixture

B. get other products at anode like fluorine

C. lower the melting point and increase the conductivity of the electrolyte

D. reduce aluminium oxide by cryolite

Answer: C

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4. In electrometallurgy of aluminium , what will happen if graphite rodes are not used as anode and are replaced by some other metal ?

A. O_2 liberated at node will react with aluminium to

give back Al_2O_3

B. F_2 will be liberated at anode instead of O_2

C. The process of electrometallurgy will become non-spontaneous

D. Aluminium oxide splits into Al^{3+} and O^{2-} ions only
in presence of graphite

Answer: A



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5. Out of the following metals that cannot be obtained by electrolysis of the aqueous solution of their salts is

A. Cr

B. Na

C. Ca

D. Mg

Answer: A

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6. Which of the following statements is correct ?

(i) Copper is extracted by hydrometallurgy from low grade ores.

(ii) In electrolytic reduction of alumina , graphite is acting as anode and steel vessel with lining of carbon acts as cathode.

(iii) In Hall-Heroult process, aluminium is obtained at anode and CO and CO_2 are produce at cathode

A. (i) only

B. (i) and (ii) only

C. (ii) and (iii) only

D. All of these

Answer: B



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Oxidation Reaction

1. In the extraction of chlorine from brine _____

A. reduction

B. displacement

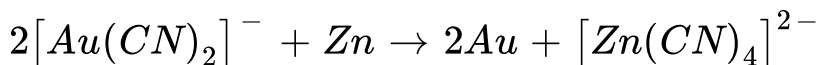
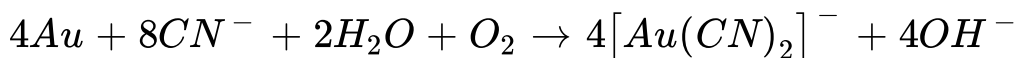
C. oxidation

D. evaporation

Answer: C

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2. Following reactions take place during extraction of gold



Zinc in the extraction of gold acts as a/an

- A. oxidising agent
- B. flux
- C. reducing agent
- D. decomposing agent

Answer: C



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

A. Al

B. Zn

C. Cu

D. Mg

Answer: A



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1. Which of the following is not a refining process?

A. Electrolysis

B. Smelting

C. Poling

D. Liquation

Answer: B



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2. In this method, a low melting metal like tin can be made to flow on a sloping surface. In this way it is separated from higher melting impurities. This method is known as

A. distillation

B. vapour phase refining

C. liquation

D. zone refining

Answer: C



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3. Most electropositive metal are obtained from their ores by

A. autoreduction

B. smelting with carbon

C. electrolysis of fused salts

D. thermal decomposition

Answer: C



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4. Which one of the following is true in electrolytic refining

?

A. Impure metal is made cathode

B. Impure metal is made anode

C. Impure metal is made cathode and pure metal as
anode

D. Both electrodes must be of pure metal.

Answer: B

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5. Carnallite on electrolysis gives

A. Mg and Cl_2

B. Ca and Cl_2

C. K and Cl_2

D. Al and Cl_2

Answer: C

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6. In electrorefining of copper, some gold is deposited as

A. cathode mud

B. electrolyte

C. anode mud

D. cathode

Answer: C



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7. During the process of electrolytic refining of copper some metals present as impurity settle as 'anode mud'.

These are

A. Sn and Ag

B. Pb and Zn

C. Ag and Au

D. Fe and Ni

Answer: C



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8. Which of the following is used as a method purification for silicon ?

A. Electrolytic refining

B. Liquation

C. Zone refining

D. Distillation

Answer: C



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9. Which of the following are main requirements for vapour phase refining ?

(i) Metal should form a volatile compound with the reagent

(ii) The volatile compound should be easily decomposable to give back pure metal

(iii) Metal should be very reactive and form a stable compound with the reagent

A. (i), (ii) and (iii)

B. (i) and (ii)

C. (ii) and (iii)

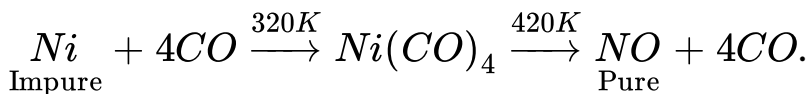
D. (i) and (iii)

Answer: B



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10. (xiv) Following equation represents a method of purification of nickel by



A. van Arkel process

B. pyrometallurgy

C. Mond process

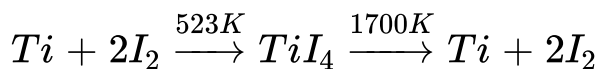
D. zone refining

Answer: C



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11. Which method of purification is represented by the following equations



A. Zone refining

B. Mond's process

C. Cupellation

D. van Arkel process

Answer: D

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12. During a column chromatography through Al_2O_3 column, a mixture of components A,B and C is passed through the column. On adding eluant, compound 'A' is eluted first then 'B' and in the end 'C'. Which of the following statements regarding the components is correct ?

A. The order of adsorption of A, B and C is $C > B > A$

B. The order of adsorption of A,B and C is $A > B > C$

C. The order of adsorption of A,B and C is $B > A > C$

D. The order of adsorption of A, B and C is $B > C > A$

Answer: A

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13. Chromatography is used for the purification of

- A. very reactive
- B. available in minute quantities
- C. present in abundance
- D. highly electropositve

Answer: B

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14. The mineral carnallite contains (i) ("_____") and (ii) ("_____") metals.
(iii) ("_____") is purified by cupellation and (iv) ("_____") is purified by distillation .

- A. (i) calcium (ii) zinc (iii) mercury (iv) tin
- B. (i) calcium (ii) magnesium (iii) zinc (iv) lead
- C. (i) potassium (ii) calcium (iii) copper (iv) mercury
- D. (i) magnesium (ii) potassium (iii) silver (iv) mercury

Answer: D



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15. Mark the correct statements.

(i) Mercury can be refined by the process of distillation.

(ii) In poling, the molten impure metal is stirred with green poles of wood.

(iii) In electrolytic refining of metals , impure metal is made as cathode and a thin strip of pure metal is made as anode.

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. (i), (ii) and (iii)

Answer: A



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16. Which of the following statements is not correct ?

A. Zinc can be extracted from its ore by roasting followed by reduction with coke.

B. In reverberatory furnace , both oxidation and reduction processes can be carried out.

C. Silver is purified by distillation or liquation process.

D. Highly pure metals are obtained by zone refining.

Answer: C



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17. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Metals used as semiconductors	(i)	Aluminium
(B)	Electrolytic reduction	(ii)	Zone refining
(C)	Cyanide process	(iii)	Dressing of ZnS
(D)	Froth floatation process	(iv)	Extraction of Ag

A. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (ii), (D) \rightarrow (i)

C. (A) \rightarrow (ii), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (i)

D. (A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (iii)

Answer: D



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18. Find the incorrect match.

A. Fine dust of aluminium - Paints and Lacquers

B. Reducing agent in the manufacture of dye-stuffs, paints etc. - Copper dust

C. For cutting tools and crushing machines - Chrome steel

D. For making cables, automobiles and aeroplane parts - Nickel steel

Answer: B



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Uses Of Aluminium Copper Zinc And Iron

1. _____ and _____ are alloys of copper.

- A. Brass and Bronze
- B. Brass and alloy steel
- C. Copper pyrites and malachite
- D. Copper glance and cuprite

Answer: A



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Higher Order Thinking Skills

1. Roasting of ores is done in

A. to burn off sulphur, arsenic , antimony etc. as oxides and convert all the iron and copper to their oxides

B. to burn off arsenic, antimony etc. as oxides and burn off sulphur so that enough of it remains to combine with all the copper.

C. to burn off sulphur partially, in order to leave enough of sulphur to combine with arsenic, antimony etc. and to convert all the iron and copper to oxides.

D. to melt arsenic and antimony sulphides etc. and remove them by liquation and to burn off sulphur

partially to leave enough to combine with copper and iron.

Answer: C

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

A. The ΔG_f° of the sulphide is greater than those for

CS_2 and H_2S

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

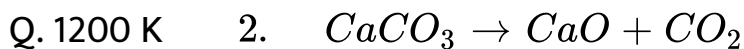
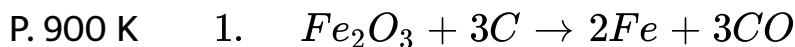
C. Roasting of the sulphide to the oxide is thermodynamically feasible.

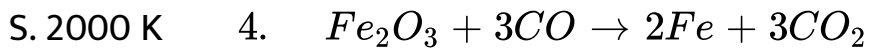
D. Carbon and hydrogen are suitable reducing agents for metal sulphides.

Answer: D

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3. Given below are the different temperature reactions and products during extraction of iron in blast furnace.





Find the correct match.

A. P-4,Q-2,R-3,S-1

B. P-4,Q-3,R-2,S-1

C. P-3,Q-4,R-1,S-2

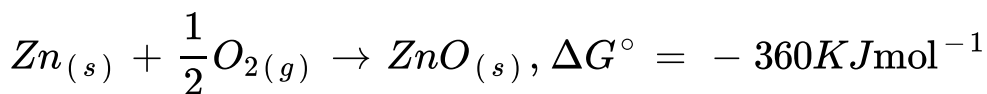
D. P-4,Q-2,R-1,S-3

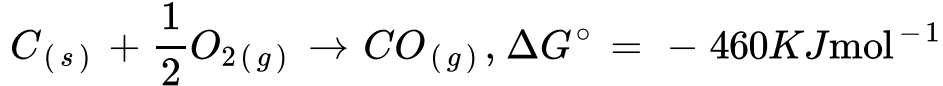
Answer: D



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4. At $1000^\circ C$,





The correct statement is

- A. zinc can be oxidised by carbon monoxide
- B. zinc blend is produced during the reaction
- C. zinc oxide can be reduced by graphite
- D. zinc can be oxidised by graphite

Answer: C

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5. Consider the following statements :

S_1 : In extraction of iron from haematite ore, the reduction reactions take place only in the lower temperature range in

the blast furnace.

S_2 : Calamine in an carbonate ore of zince.

S_3 : The principle ore of aluminium , bauxite , usually contains silica, iron oxides and titanium oxide as impurities.

S_4 : Solidified copper obtained from silica lined conventor (Bessemer converter) has blistered appearance due to the evolution of SO_2 .

Which are correct statements?

A. I and II

B. II and III

C. I and III

D. II, III and IV

Answer: C



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6. Four metals and their methods of refinement are given

(i) *Ni, Cu, Zr, Ga*

(ii) Electrolysis, Val Arkel process, zone refining, Mond's process

Choose the right method for each :

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

Zr : Zone refining, Ga: Mond's process

B. Ni: Mond's refining ,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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Ncert Exemplar

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: A

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

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

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

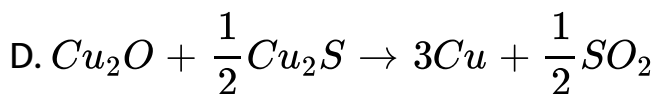
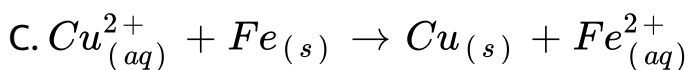
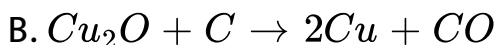
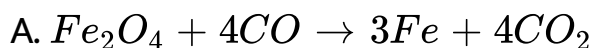
C. sulphides of copper (I) and iron (II)

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

Answer: C

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



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 in pure metal

Answer: B



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

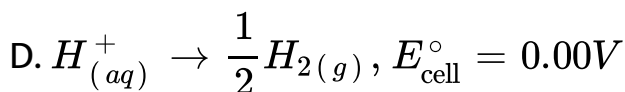
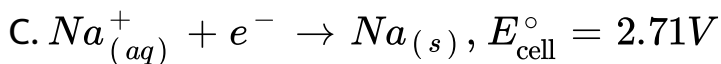
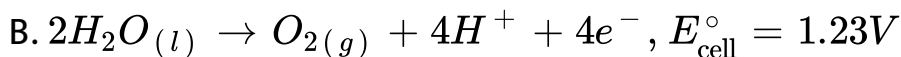
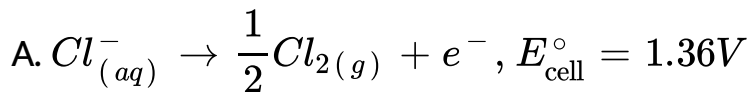
- A. FeS
- B. CO
- C. Cu_2S
- D. SO_2

Answer: C



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



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 change 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. displacemtn 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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Assertion And Reason

1. Assertion : Minerals are naturally occurring chemical substances in the earth's crust obtainable by mining.

Reason : Minerals are also known as ores.

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

- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C

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2. Assertion : In froth floatation method, collectors such as pine oil or xanthates are added to the suspension of powdered ore.

Reason : Collectors stabilise the froth.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C

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3. Assertion : Gold and silver are extracted from their native ores by leaching.

Reason : Both silver and gold particles dissolve in dilute solution of sodium cyanide in presence of oxygen.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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4. Assertion: Roasting is a process in which the ore is heated in presence of air Reason: Concentration of sulphide ore is done by calcination

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D



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5. Assertion : Reduction of a metal oxide is easier if the metal formed is in liquid state at the temperature of reduction. Reason : The entropy is higher if the metal is in liquid state.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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6. Assertion : Sulphide ores are converted to oxides before reduction.

Reason : Oxides are easier to reduce.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A



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7. Assertion : Magnesium metal is not used for the reduction of alumina in the metallurgy of aluminium.

Reason : MgO curve lies above Al_2O_3 curve in Ellingham diagram.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C



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8. Assertion : In the metallurgy of aluminium , purified Al_2O_3 is mixed with Na_3AlF_6 or CaF_2 .

Reason : Na_3AlF_6 or CaF_2 lowers the melting point of mixture and increases its conductivity.

A. 1. If both assertion and reason are true and reason is the correct explanation of assertion .

B. 2. if both assertion and reason are true but reason is not the correct explanation of assertion

C. 3. If assertion is true but reason is false

D. 4. If both assertion and reason are false.

Answer: A



9. Assertion: Limestone added in the blast furnace decomposes to give CaO which forms slag in molten state and separates out from iron

Reason : The iron obtained from the blast furnace contains about 4% carbon and many impurities like S,P, Si, Mn, etc.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: B

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10. Assertion : Tin is refined by liquation method.

Reason : Tin has low melting point as compared to impurities .

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: A

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11. Assertion : In electrolytic refining of metal, impure metal is made cathode while a strip of pure metal is used as anode.

Reason : The pure metal gets deposited at anode as anode mud.

A. 1. If both assertion and reason are true and reason is the correct explanation of assertion .

B. 2. if both assertion and reason are true but reason is not the correct explanation of assertion

C. 3. If assertion is true but reason is false

D. 4. If both assertion and reason are false.

Answer: D



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12. Assertion: Zone refining method is used to produce pure metals which are used as semiconductors.

Reason: Semiconductors are used in highly pure form.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B



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13. Assertion: Nickel is purified by reaction it with CO .

Reason: Impurities present in nickel form volatile compounds.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C



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14. Assertion : van Arkel method is used for refining of Zinc.

Reason : In this method impure is evaporated to obtain the pure metal as distillate .

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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15. Assertion : Chromatography in general involves a mobile (a gas, a liquid or a supercritical fluid) and a stationary phase (like Al_2O_3 column).

Reason : A component which is less soluble in stationary phase takes longer time to travel through it than the component which is more soluble in stationary phase.

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. if both assertion and reason are true but reason is not the correct explanation of assertion
- C. If assertion is true but reason is false
- D. If both assertion and reason are false.

Answer: C

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