CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

Advanced Problems For Competitons

1. Two minerals (X) and (Y) are concentrated by floth floatation process. On roasting mineral (X) gave a shining liquid metal (Z) while mineral (Y) under similar condition gave a metal oxide (P) which was yellow when hot and while when cold. Reduction of the oxide (P) withe coke gave metal (Q). Identify the minerals (X) and (Y), the oxide (Z) and metals (P) and (Q).

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2. You are provided with the following ΔG° values :

$S_8 + 2O_2 \rightarrow 2SO_2$, ΔG° at 1073K = - 544 kJ

$2Zn + S_2 \rightarrow 2ZnS$, ΔG° at 1073K = -293kJ

$2Zn + O_2 \rightarrow 2ZnO$, ΔG° at 1073K = -480kJ

Calculate ΔG° at 1073 K for the following reaction at this remperature,

$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

and predict whether this reaction is thermodynamically feasible or not.

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3. Free energies of formation $\left(\Delta_f G^{\ominus}\right)$ of $MgO(s)$ and $CO_{(g)}$ at $1273K$ and $2273K$ are given below :

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

$\Delta_f G^{\ominus}\left(MeO_{(s)}\right) = -314 kJ/mol at 2273K$

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

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

On the basis of above data, predict the temperature at which carbon can be used as a reducing for agent $MgO_{(s)}$.

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4. Bauxite is the principle ore of aluminium. It cannot be reduced with carbon to give the corresponding metal but when heated at 2273K, it gives compound (X) which upon treatment with water gives a gas (Y) which is the major constituent of natural gas. Identify (X) and (Y) and explain the reactions involved therein.

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5. Give plausible reasons for the following :

(i) Pure alumina is a bad conductor of electricity. To make it conducting, two substances (X) and (Y) are added to molten alumina before carrying out electrolysis using carbon electrodes. Why are carbon electrodes preferred over metal electrodes ?

(ii) During electrolysis, the surface of the molten electrolyte is covered with a substance (Z). Identify the substances (X), (Y) and (Z) and explain their functions.

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6. Haematite, an ore of iron, first concentrated and then calcined. The calcined ore is then heated in a blast furnace in presence of coke the limestone and at the same time a blast of

hot air (pre heated to 1000 K) is introduced into the furnace through tuyeres. Two products (X) and (Y) are obtained. Now answer the following questions.

(a) What method is used for concentration of haematite ore ?

(b) What happens during calcination ?

(c) Identiy the two products and mention their uses.

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7. Consider the following metallurgical operations for two ores of copper (X) and (Y).

$$X \xrightarrow{\text{Calcination}} \text{Black ppt.}(C) + CO_2 + H_2O$$

$$Y \xrightarrow{\text{Roasting}} \text{Metal M} + \text{Gas(G)}$$

Identify (X), (Y), (Z), (M) and (G).

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8. (i) A black mineral (A) on treatment with dilute sodium cyanide solution in present of air gives a clear solution of (B) and (C).

(ii) The solution of (B) on reaction with zinc gives precipitate of a metal (D).

Identify (A) and (D) and explain the reactions of steps (i) and (ii).

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9. A mineral(X) concentrated by froth floatation process was roasted in a reverberatory furance go give two compojnd (A) and (B) whichwere later partially oxidizes, B was more easily oxidised than A) to give compounds (C) and (D) respectively. The roasted ore was mixed with silica and some powdered coke and later smalted when two layers of moltenmass was obtained-the upper layer was that of salg (E) while the lower

layer is called matte (F). The molten mattel was then transferred to a bessemer converter and a blastof hot air and sand waspassed through it when the metal (Y) was obtained.Identify the mineral (X), the meta (Y) and the compounds (A-F)

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Test Your Grip I Multiple Choice Questions

1. Which one of the following is most abudant in earth crust ?

A. Mg

B. Na

C. Al

D. Fe

Answer: C

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2. The metal always found in the free state is

A. Au

B. Ag

C. Cu

D. Na

Answer: A

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3. Copper is extracted from

A. cuprite

B. copper glance

C. malachite

D. copper pyrites

Answer: D

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4. The salt which is least likely to be found in mineral is

A. chloride

B. sulphate

C. sulphide

D. nitrate.

Answer: D

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5. Which of the following benefication processes is used for the mineral $Al_2O_3.2H_2O$?

A. Froth floatation

B. Leaching

C. Liquation

D. Magnetic separation.

Answer: B

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6. Ore dressing for iron is done by

A. Froth floatation process

B. Magnetic separation

C. Hand picking

D. All the above.

Answer: B

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7. Heating pyrites to remove sulphur is called

A. smelting

B. calcination

C. liquation

D. roasting.

Answer: D

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8. For which of the following ores, froth floatation process is applicable ?

A. Oxide

B. Sulphide

C. Carbonate

D. Sulphate

Answer: B

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9. Consider the following reaction at $1000^\circ C$

(A) $Zn(s) + \frac{1}{2}O_2(g) \rightarrow ZnO(s), \Delta G^\Theta = -360kJmol^{-1}$

(B) $C(s) + \frac{1}{2}O_2(g) \rightarrow OO(g), \Delta G^\Theta = -460kJmol^{-1}$

Choose the correct statement at $1000^\circ C$

A. zinc can be oxidised by carbon monoxide.

B. zinc oxide can be reduces by graphite.

C. both statements (a) and (b) are true.

D. both statements (a) and (b) are false.

Answer: B

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10. Which of the following reactions taking place in the blast furnace during extraction of iron is endothermie ?

A. $CaCO_3 \rightarrow CaO + CO_2$

B. $2C + O_2 \rightarrow 2CO$

C. $C + O_2 \rightarrow CO_2$

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

Answer: A

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11. Smelting involves reduction of metal oxide with

A. carbon

B. carbon dioxide

C. magnesium

D. aluminium

Answer: A

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12. During smelting, an additional substance is added which combines with impurities to form a fusible product. The substance added is known as :

A. flux

B. slag

C. gangue

D. ore.

Answer: A

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13. Which step is not involved in hydrometallurgical process ?

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

B. $CuSO_4 + Fe \rightarrow Cu + FeSO_4$

C. $CuFeS_2 + 2H_2SO_4 \rightarrow CuSO_4 + FeSO_4 + 2H_2S$

D. $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$

Answer: A

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14. Which method is not correct for refining of crude metals ?

A. Liquation : tin

B. Zone refining : silicon

C. Mond process : aluminium

D. Electrolytic refining : blister copper

Answer: C

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15. Mond's process is used for refining of

A. Ni

B. Ag

C. Sn

D. Al

Answer: A

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16. In the process of extraction of gold.

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

$[X] + Zn \rightarrow [Y] + Au$

Identify the complexes $[X]$ and $[Y]$.

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

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

C. $X = \left[Au(CN)_2\right]^-, Y = \left[Zn(CN)_6\right]^{4-}$

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

Answer: A

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17. In extraction of gold, zinc acts as

A. flux

B. oxidising agent

C. reudcing agent

D. none.

Answer: C

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

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

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

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

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

Answer: D

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Test Your Grip Ii Fill In The Blanks

1. The naturally occurring chemical substances in form of which occur in the earth along with impurities are called ___.

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2. Minerals from which metals are extracted conveniently and economically are called ___.

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3. The earthly and siliceous impurities which generallty occur with ores are called _____or _____

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4. The complete of extracting the metal form its ores is called _____.

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5. Highly reactive elements occurs in nature in____state.

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6. The most abundant metal in the earth's crust is ..... .

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7. Calcination is the process of heating the ore strongly in the _____of air.

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8. An ore of tin containing $FeCrO_4$ is concentrated by ..... .

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9. _____ores are concentrated by froth flotation and roasted in excess of air to convert them into their respective _____.

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10. ____involves treating the powdered ore with a suitable reagent which selectively dissolves the ore but not the impurities.

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11. Sodium cyanide solution is used to extract ____or ____from its ores.

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12. Flux combines the infusible impurities to form____.

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13. ____acts as an acidic flux while____acts as a basic flux.

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14. In the metallurgy of copper, the flux used to remove the basic impurity of FeO is _____.

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15. During extraction of iron from haematite, the flux used is _____.

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16. ..... involves reduction of metal oxide with coke or carbon monoxide.

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17. In the thermite process, _____is used as a reducting agent.

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18. .....is the purest form of iron.

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19. Above 1073 K, ... reduces FeO to Fe while below 1073K, ... reduces Fe_2O_3 to Fe.

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20. Highly electropositive metals like sodium, megnesium or aluminium are obtained by .....of their purified molten

ores.

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21. Low melting metals like lead in tin are refined by ..... .

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22. In the Mond's process,..... is used to purify impure nickel.

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23. In the van Arkel process .....is used to purify .....or..... .

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24. .....is used to prepare semiconductor grade silicon or germanium.

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25. During extraction of iron from haematite, the slag formed consists of .....while the slag formed during extraction of copper from copper pyrites consists of ..... .

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26. .....is added to Al_2O_3 in Hall - Heroult process for extraction of aluminium to .....the melting point and to .....the electrical conductivity of the melt.

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Conceptual Questions

1. Copper and silver lie below hydrogen in electrochemical series and yet they are found in the combined state as sulphides in nature. Comment.

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2. What is fool's gold ?

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3. Account for the fact that pine oil is used in the froth floatation process.

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4. What is flux ? What is the role of flux in the metallurgy of iron and copper ?

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5. What is flux ? Name an acid flux.

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6. What is the role of limstone in the extraction of iron from its oxides ?

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

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8. Out of C and CO which is a better reducing agent for FeO

(i) In the lower part of blast furnace (higher temperature)

(ii) In the upper part of blast funace (lower temperature)

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9. How is wrought iron different from steel ?

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10. What is the principle of thermite process ? Name two meals which can be extracted with the help of this process.

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11. Why does copper obtained in the extraction fromcopper pyrite have blistered appearance ? `

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12. Which metals are generally extracted by the electrolytic processes ? What positions these metals generally occupy in the periodic table?

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13. Indicate the principle behind the method used from refining of zinc ?

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14. Name the method of refining of nickel.

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Ncert Questions And Exercises With Answers Ncert Intext Solved Questions

1. Suggest a condition unders which magnesium could reduce alumina.

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

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

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

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

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Ncert Questions And Exercises With Answers Ncert Intext Unsolved Questions

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

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

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3. The reaction

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

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

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4. The under certain conditions magnesium can be reduce SiO_2 and silicon can reduce MgO. What are those conditions?

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Ncert Questions And Exercises With Answers Ncert Exercises

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

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2. What is the role of depressant in froth floatation process ? Give an example.

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

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4. Explain:

(i). Zone refining

(ii). Column chromatography.

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5. Which is better reducing agent at 983 K, C or CO ?

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

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

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

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

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

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

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12. Describe a method for refining nickel.

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

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14. Giving examples differentiate between roasting and calcination.

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15. How is cas iron different from pig iron ?

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16. Differentiate between “minerals” and “ores”.

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

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

Watch Video Solution

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

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

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

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

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

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

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

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

(a) Electrolytic refining

(b) Zone refining

(c) Vapour phase refining.

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

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Ncert Exemplar Problems With Answers Hints And Solutions Multiple Choice Questions I

1. In the extraction 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. sulphides of copper (I) and iron (III)

Answer: C

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

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

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

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

D. $Cu_2O + \frac{1}{2}Cu_2S \rightarrow 3Cu + \frac{1}{2}SO_2$

Answer: D

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

A. Al and Fe

B. Al and Cu

C. Fe and Cu

D. Cu and Ag

Answer: A

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5. Zone refining is based on the principle that

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

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

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

D. vapours of volatile compound can be decomposed 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_____

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

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

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

D. $H^+(aq) + e^- \rightarrow \frac{1}{2}H_2O(g), E^\circ_{\text{cell}} = 0.00V$

Answer: A

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8. In the metallurgy of aluminium,

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

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

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

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

Answer: B

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

A. Cu and Zn

B. Ge and Si

C. Zr and Ti

D. Zn and Hg

Answer: A

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

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

B. roasting of metal complex

C. calcination followed by roasting

D. thermal decomposition of metal complex

Answer: A

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

A. Below temperature at point A

B. Approximately at the temperature corresponding to point A

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

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

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

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

Answer: A

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Ncert Exemplar Problems With Answers Hints And Solutions Multiple Choice Questions Ii

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

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

A. Point A

B. Point B

C. Point D

D. Point E

Answer: B::D

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Ncert Exemplar Problems With Answers Hints And Solutions Multiple Choice Questions Ii

1. Which of the following options are correct ?

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

B. In extraction of silver, silver is extracted as cationic complex

C. Nickel is purified by zone refining

D. Zr and Ti are purified by van Arkel method

Answer: A::D

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2. In the extraction of aluminium by Hall-Heroult process purified Al_2O_3 is mixed with CaF_2 to

A. lower the melting point of Al_2O_3

B. increase the conductivity of molten mixture

C. reduce Al^{3+} into Al

D. acts as catalyst

Answer: A::B

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

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

B. Collectors enhance the wettability of gangue particles

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

D. Froth stabilisers decrease wettability of gangue

Answer: A::C

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4. In the Froth Floatation process, zinc sulphide and lead sulphide can be separated by_____

A. using collectors

B. adjusting the proportion of oil to water

C. using depressant

D. using the froth stabilisers

Answer: B::C

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5. Common impurities present in bauxite are.....

A. CuO

B. ZnO

C. Fe_2O_3

D. SiO_2

Answer: C::D

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

A. Haemetite

B. Galena

C. Copper pyrites

D. Magnetite

Answer: B::C

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7. Which of the following reaction occur during calcination ?

A. $CaCO_3 \rightarrow CaO + CO_2$

B. $2FeS_2 + \frac{1}{2}O_2 \rightarrow Fe_2O_3 + 4SO_2$

C. $Al_2O_3xH_2O \rightarrow Al_2O_3 + xH_2O$

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

Answer: A::C

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

A. haematite

B. calamine

C. iron pyrites

D. sphalerite

Answer: A::B

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

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

B. $FeO + SiO_2 \rightarrow FeSiO_2$

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

D. $CaO + SiO_2 \rightarrow CaSiO_3$

Answer: A::D

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10. In which of the following method of purification metal is converted to its volatile compound which is decomposed to

give pure metal?

A. heating with stream of carbon monoxide

B. heating with iodine

C. liquation

D. distillation

Answer: A::B

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11. Which of the following statements are correct ?

A. A depressance prevents certain type of particle to come to the froth

B. Copper matte contain Cu_2S and ZnS

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

D. Zinc can be extracted by self - reduction .

Answer: A::C

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12. In the extraction of chlorine from brine_____

A. ΔG° for the overall reaction is negative

B. ΔG° for the overall reaction is positive

C. E° for overall reaction has negative value

D. E° for overall reaction has positive value

Answer: B::C

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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28. Give two requirements for vapour phase refining.

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

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Ncert Exemplar Problems With Answers Hints And Solutions Short Answer Questions

1. Why is an external emf of more than $2.2V$ required for the extraction of CI_2 from brine?

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Ncert Exemplar Problems With Answers Hints And Solutions Matching Type Questions

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

$ColumnI$	$ColumnII$
(A)Pendulum	(1)Chrome steel
(B)Malachite	(2)Nickel steel
(C)Calamine	$(3)Na_3AlF_6$
$(D)Cryolite$	$(4)CuCO_3.Cu(OH)_2$
	$(5)ZnCO_3$

A. A(1) B(2) C(3) D(4)

B. A(2) B(4) C(5) D(3)

C. A(2) B(3) C(4) D(5)

D. A(4) B(5) C(3) D(2)

Answer: B

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2. Match the items of Column I with the items of Column II and assign the correct code:

$Column I$	$Column II$
(A) Coloured bands	(1) Zone refining
(B) Impure metal to volatile complex	(2) Fractional distillation
(C) Purification of Ge and Si	(3) Mond process
(D) Purification of mercury	(4) Chromatography
	(5) Liquation

A. A(1) B(2) C(4) D(5)

B. A(4) B(3) C(1) D(2)

C. A(3) B(4) C(2) D(1)

D. A(5) B(4) C(3) D(2)

Answer: B

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3. Match items of Column I with the items of Column II and assign the correct code:

$Column I$	$Column II$
(A) Cyanide process	(1) Ultrapure Ge
(B) Froth Floatation Process	(2) Dressing of ZnS
(C) Electrolytic reduction	(3) Extraction of Al
(D) Zone refining	(4) Extraction of Au
	(5) Purification of Ni

A. A(4) B(2) C(3) D(1)

B. A(2) B(3) C(1) D(5)

C. A(1) B(2) C(3) D(4)

D. A(3) B(4) C(5) D(1)

Answer: A

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4. Match the items of Column I with the items of Column II and assign the correct code:

$Column I$	$Column II$
(A) Sapphire	$(1)\, Al_2O_3$
(B) Sphalerite	$(2)\, NaCN$
(C) Depressant	$(3)\, Co$
(D) Corundum	$(4)\, ZnS$
	$(5)\, Fe_2O_3$

A. A(3) B(4) C(2) D(1)

B. A(5) B(4) C(3) D(2)

C. A(2) B(3) C(4) D(5)

D. A(1) B(2) C(3) D(4)

Answer: A

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5. Match the items of Column I with items of Column II and assign the correct code:

$Column I$	$Column II$
(A) Blisterred Cu	(1) Aluminium
(B) Blast furnace	$(2) 2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$
(C) Reverberatory furnace	$(3) Iron$
(D) Hall-Heroult process	$(4) FeO + SiO_2 \rightarrow FeSiO_3$
	$(5) 2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

A. A(5) B(4) C(3) D(2)

B. A(1) B(2) C(3) D(5)

C. A(5) B(4) C(3) D(2)

D. A(4) B(5) C(3) D(2)

Answer: A

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Ncert Exemplar Problems With Answers Hints And Solutions Assertion And Reason Type Questions

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

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

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A

Watch Video Solution

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

Reason : ZrI_4 is volatile and decomposed at $1800K$.

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A

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

Reason : Cresols stabilise the froth in Froth Floatation method.

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: B

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

Reason : Semiconductors are of high purity.

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: B

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

Reason : Copper is extracted by hydrometallurgy.

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: C

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Ncert Exemplar Problems With Answers Hints And Solutions Long Answer Questions

1. Explain the following :

(a) CO is a better reducing agent below 983 K whereas C is a better reducing agent above 983 K

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

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

(d) Carbon and hydrogen are not used as reucing agents at high temperatures.

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

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Additional Questions Very Short Answer Questions

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

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2. Why do metal sulphides occur mainly in rocks and metal halides in lakes and seas?

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3. Give the names of the four most abundant elements in the earth's crust? Arrange them in decreasing abundance.

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4. Name a sulphide ore of copper.

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5. What is a mineral? How does it differ from an ore?

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6. What is meant by benefaction process ?

Watch Video Solution

7. What is gangue ?

Watch Video Solution

8. What type of ores can be concentrated by magnetic separation method ?

Watch Video Solution

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

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10. (a) Why is it that only sulphide ores are concentrated by froth floatation process ?

or Why is the froth floatation process selected for the concentrated of sulphide ores ?

(b) Which of the following ores can be concentrated by froth floatation method and why ?

Fe_2O_3, ZnS, Al_2O_3

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11. Write the name of the method of concentrated applied for the following ores :

(i) Zinc blende

(ii) Haematite

(iii) Bauxite

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12. Out of PbS and $PhCO_3$ (ores of lead), which one is concentrated by froth floatation process preferably ?

Watch Video Solution

13. Metal sulphides occur mainly in rocks and metal halides occur in lakes and seas. Give reason.

(b) Pine oil is used in froth flatation process. Why ?

(c) What is a depresent ? Give an example.

(d) What is the role of stabiliser in froth flotation process ?

(e) What is gangue ?

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14. What is the role of collectors in froth floatation process ? Give an example of a collector.

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15. A sample of galena is contaminated with zinc blende. Name one chemical which can be used to concentrate galena selectively by froth floatation method.

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

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17. What is slag ? Give one example.

Watch Video Solution

18. What type of ores are roasted?

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19. What is meant by the term 'pyrometallurgy' ?

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20. Indicate the temperature at which carbon can be used as a reducing agent for FeO.

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21. What is the role of coke in the extraction of iron from its oxides ?

Watch Video Solution

22. Name the reducing agent to obtain iron from Fe_2O_3 at high temperature.

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23. Write a non - exothermic reaction takind place in the blast furnace during extraction of iron.

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24. Which form of the iron is the purest form of commercial iron ?

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

Watch Video Solution

26. What is the composition of 'Copper matte'?

Watch Video Solution

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

Watch Video Solution

28. Which reducing agent is employed to get copper from the leached low-grade copper ore ?

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29. Write the overall reaction taking place in the process used for the electrolysis of alumina by Hall- Heroult process.

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30. How are tin and lead purified ?

Watch Video Solution

31. Mention two important substances present in the 'anode mud' obtained in the electrorefining of copper.

Watch Video Solution

32. What is the principle of zone refining ?

Watch Video Solution

33. Give an example of zone refining of metals.

Watch Video Solution

34. Write the anem of the method used for refining of the following metals :

(i) Titanium (ii) Germanium (iii) Copper

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35. Write the principle of the method used for refining of germanium.

Watch Video Solution

36. Name the method used for refining of (i) copper metal (ii) nickel metal.

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37. What is Van Arkel method of obtaining ultrapure metals ?

Watch Video Solution

38. Define amalgamation. Discuss its use in the purification of gold and silver. Can Fe be purified by this method ?

Watch Video Solution

39. What are the main components of invar ?

Watch Video Solution

Additional Questions Short Answer Questions

1. How do the elements occur in nature ?

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

Watch Video Solution

3. Giving appropriate examples (at least three), explain how the reactivity of a metal is related to its mode of occurrence in nature.

Watch Video Solution

4. (a) Name the chief form of occurrence of the following in the earth's crust :

(i) iron (ii) copper (iii) zinc

(b) Name the principle ore of aluminium.

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5. Predict the modes of occurrence of the following three types of metals :

(a) Highly reactive (e.g Na)

(b) Moderately reactive (e.g Fe)

(c) Noble metal (e.g Au).

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6. What is the difference between mineral and ore ?

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7. All ores are minerals , but all minerals are not ores. Why ?

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8. How do non-metals occur in nature ? How are they extracted//isolated from their natural sources ?

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9. What is meant by concentration of ores ?

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10. Describe magnetic separation method of concentration of ores.

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11. Describe the principle of froth flotation process. What is the role of a stabiliser and of a depressant ? Give one example of each.

Watch Video Solution

12. Describe the principle of froth floatation process.

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13. What is meant by leaching ? Give reactions involved during leaching of alumina.

Watch Video Solution

14. Describe the leaching of aluminium ore.

Watch Video Solution

15. Write the chemical equations involved in the preparation of pure alumina from bauxite by Baeyer's process.

Watch Video Solution

16. Describe the pinciple controlling the preparation of pure alumina from the bauxite ore.

Watch Video Solution

17. Mention the role of cryolite in the extraction of aluminium.

Watch Video Solution

18. Silver ores and native gold have to be leached with metal cyanides. Suggest a reason for this.

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19. Describe the role of the following :

(i) NaCN in the extraction of silver from silver ore.

(ii) NaCN in the extraction of gold from gold ore.

Watch Video Solution

20. What is the main difference between ?

(i) Cupellation and poling

(ii) Hydrometallurgy and pyrometallurgy

(iii) Leaching and Levigation

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21. Differentiate between roasting and calcination.

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22. Explain the term calcination and roasting with suitable examples of each.

Watch Video Solution

23. Carbonate ores are usualy subjected to calcination while sulphide ores are subjected to roasting. Comment on the statement.

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24. What is a flux ? Discuss its types and uses in metallurgical operations.

Watch Video Solution

25. Differentiate between the following :

(i) Flux and slag

(ii) Smelting and roasting

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26. Draw the Ellingham diagram for the formation of carbon monoxide. What happens to the stability of carbon monoxide with the increase in temperature ?

Watch Video Solution

27. Is carbon a satisfactory reducing agent for all metal oxides ? Give reasons.

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Watch Video Solution

28. What chemcial princpicl is involved in choosing a reducing agent for getting the metal from its oxide ore? Consider the metal oxides Al_2O_3 and Fe_2, O_3 and justify and choice of reducing agent in each case.

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29. What is the chief ore of iron ? Write chemical reactions taking place in the extraction of iron from its ore.

Watch Video Solution

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

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31. Describe how the following changes are brought about :

(i) Pig iron into steel

(ii) Zinc oxide to metallic zinc.

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32. Describle the principal controlling each of the following processes:

(i) Preparation of cast iron from pig iron.

(ii) Preparation of pure alumina (Al_2O_3) form bauxite ore.

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33. Explain the following steps with chemical equations in the extraction of copper from copper pyrite ore :

(i) roasting

(ii) smelting.

Watch Video Solution

34. Describe the role of the following :

(i) Limestone in the metallurgy of iron.

(ii) SiO_2 in the extraction of copper from copper matte.

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35. What is the role of following ?

(a) Depressant in the froth floatation process.

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

(c) Cryolite in the metallurgy of aluminium.

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36. Write the chemical reactions which take place in the following operations :

(i) Electrolytic reduction of Al_2O_3

(ii) Isolation of zinc from zinc blende.

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

(a) Nickel

(b) Zirconium

(c) Tin

(d) Germanium

(e) Zinc

Watch Video Solution

38. Describe the principle involved in each of the following processes:

(a) Mond process for refining of nickel.

(b) Column chromatography for purification of rare elements.

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39. Outline the principples behind the refining of metals by the following methods :

(i) Zone refining method

(ii)Chormatographaphic method

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Additional Questions Long Answer Questions

1. Give the uses of aluminium, copper, zinc and iron.

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Higher Order Thinking Skills Hots Questions Questions And Problems With Answers Hot Questions

1. Metals like Cu, Ag, Zn, Hg and Pb occur in nature as sulphides rather than oxides ? Why ?

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2. Metals donot occur in nature as nitrates. Why ?

Watch Video Solution

3. Why is it advantageous to roast a sulphide ore to the oxide before reduction ?

Watch Video Solution

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

Watch Video Solution

5. Explain the following :

(i) Zinc but not copper is used for the recovery of Ag from $[Ag(CN)_2]^-$

(ii) Partial roasting of sulphide ore is done in the metallurgy of copper.

(iii) Why is chalcocite roasted and not calcined during extraction of copper ?

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6. Cinnabar (HgS) and galena (PbS) on roasting often give their respective metals, but zinc blende (ZnS) does not. Give reason.

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7. Which of the following metals cannot be extracted by the smelting process ?

Al, Zn, Fe, Pb

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8. Why can't aluminium be reduced by carbon ?

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9. Graphite is used as an anode but not diamond. Give reason.

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10. Both iron and aluminium combine slowly with oxygen at room temperature. Why is this reaction a problem for iron but not for aluminium?

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11. Suggest one method for separation of nickel from cobalt ?

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12. Conventional methods cannot be used for separation of individual lanthanoid elements beacause their properties are quite similar. Suggest a suitable method for their separation.

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Value Based Questions With Answers

1. When Manu came from school, he saw his mother talking to a person who claimed that he would polish her tarnished silver/gold bangles charging only a nominal amount of money. Out of curiosity, Manu asked the person concerned as to how would he polish the bangles ? The man showed him a slivery liquid. Using his knowledge of chemistry, Manu immediately saw through the trick and asked his mother not the get the bangles polished and requested the man to please go away. Read this passage and answer the following questions :

(i) Name the silvery liquid with with the bangles were to be rubbed.

(ii) Why did Manu ask his mother not to get the bangles polished ?

(iii) What benefit does the man derive from rubbing the silver

/gold bangles with silvery liquid ?

(iv) As a student of chemistry, what initiative would you take to save the innocent women in the streets and mohallas from being cheated by quacks ?

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2. Amit wanted to renovate his office. He wanted to install doors/ windows made up of iron but his friend suggested him to use windows/doors made up of aluminium. Amit accepted the suggestion of his friend.

After reading the above passage, answer the following questions :

(i) What values are suggested by Amit's friend which changed his mind to use windows/doors made up of aluminium instead or iron ?

(ii) Give one principle ore each of iron and aluminium.

(iii) How is iron and aluminium obtained from their respective ores ?

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3. Shelly visited heer sister Jyotsna house and found that all the water taps were rusted. She told her that instead of iron taps she should use nickel or chrome plated taps. She accepted her suggested. After reading the above passage, answer the following questions :

(i) What is the value associated with Shelly's suggestion ?

(ii) How is nickel or chrome plating carried out ?

(iii) Name a few nickel/chrome plated articles which are used in our daily life.

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Competition Focus Jee Main And Advanced Medical Entrance Special Multiple Choice Questions I

1. Which ore of the following is a mineral of iron ?

A. Malachite

B. Cassiterite

C. Pyrolusite

D. Magnetite

Answer: D

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2. The ore having two different metal atoms is

A. haematite

B. galena

C. magnetite

D. copper pyrites

Answer: D

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3. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are

A. II, III in haematite and III in magnetite

B. II, III in haematite and II in magnetite.

C. II in haematite and II and III in magnetite.

D. III in haematite and II and III in magnetite.

Answer: D

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4. In which of the following minerals, Aluminium is not present ?

A. Cryolite

B. Mica

C. Fledspar

D. Fluorspar.

Answer: D

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5. Sulphide ores are common for the metals

A. Ag, Cu and Pb

B. Ag, Cu and Sn

C. Ag, Mg and Pb

D. Al, Cu and Pb

Answer: A

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

I.Metal nitrates are highly unstable.

II. Metal nitrates are highly soluble in water.

A. I is false but II is true

B. I is true but II is false.

C. I and II are false

D. I and II are false

Answer: A

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7. In the froth flotation process for benefication of ore, the ore particles float because

A. they are light

B. their surface is not easily wetted by water

C. they bear electrostatic charge

D. they are insoluble

Answer: B

Watch Video Solution

8. The function of potassium ethyl xanthate in frotht floatatation process is to make the ore

A. attrached towards water

B. water repellant

C. porous

D. heavier

Answer: B

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9. $NaCN$ is sometimes added in the froth flotation process as a depressant when ZnS and PbS minerals are expected because :

A. Pb $(CN)_2$ gets precipitated without any effect on ZnS

B. ZnS froms soluble complex, $Na_2\left[Zn(CN)_4\right]$ while PbS forms the froth

C. PbS forms soluble complex, $Na_2\left[Pb(CN)_4\right]$ while ZnS forms froth

D. $Zn(CN)_2$ gets precipitated without any effect on PbS.

Answer: B

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10. Which one of the following ores is best concentrated by froth floatation method ?

A. Magnetite

B. Siderite

C. Galena

D. Malachite

Answer: C

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11. Sphalerite is concentrated by

A. gravity separation

B. froth floatation

C. magnetic separtion

D. hydraulic washing

Answer: B

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12. Bauxite ore is made up of $Al_2O_3 + SiO_2 + TiO_2 + Fe_2O_3$. This ore is treated with conc. NaOH solution at 500 K and 35 bar pressure for a few hours and filtered hot. In the filtrate the species present are :

A. $NaAl(OH)_4$ only

B. $Na_2Ti(OH)_6$ only

C. $NaAl(OH)_4$ and Na_2SiO_3 both

D. Na_2SiO_3 only

Answer: C

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13. In the leaching of Ag_2S with $NaCN$, a stream air is also passed. It is because of

A. the reaction between Ag_2S and $NaCN$ is reversible

B. to oxidise Na_2S formed in the reaction to Na_2SO_4

C. to oxide Ag_2S to Ag_2O

D. both (a) and (b)

Answer: D

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14. The complex formed when Al_2O_3 is leached from bauxite using concentrated NaOH is :

A. $Na\left[Al(OH)_4\right]$

B. $NaAl_2O_4$

C. $Na_2\left[Al(OH)_3\right]$

D. Na_2AlO_2

Answer: A

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

A. Sphalerite

B. Argentite

C. Galena

D. Copper pyrite

Answer: B

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16. In the equatio, $4M + 8CN^- + 2H_2O + O_2 \rightarrow 4\left[M(CN)_2\right]^- + 4OH^-$, the metal M is

A. Copper

B. Iron

C. Gold

D. Zinc.

Answer: C

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

A. O_2 and CO respectively

B. O_2 and Zn dust respectively

C. HNO_3 and Zn dust respectively.

D. HNO_3 and CO respectively.

Answer: B

Watch Video Solution

18. Which one of the following reactions is an example for calcination process ?

A. $2Ag + 2HCl + [O] \rightarrow 2AgCl + H_2O$

B. $2Zn + O_2 \rightarrow 2ZnO$

C. $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

D. $MgCO_3 \rightarrow MgO + CO_2$

Answer: D

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19. When limestone is heated CO_2 gas is liberated. In metallurgy, this process is called as

A. smelting

B. reduction

C. calcination

D. roasting

Answer: C

Watch Video Solution

20. Which of the following faction is of no significance for roasting sulphide ores to the oxide and not subjecting the sulphide ores in carbon reduction directly ?

A. CO_2 is more volatile thn CS_2

B. Metal sulphide are thermodynamically more stable than CS_2

C. CO_2 is thermodynamically more stable than CS_2

D. Metal sulphides are less stable than the corresponding oxides

Answer: B

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

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

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

C. The $\Delta_f G^\circ$ of the sulphide is greater then those for CS_2 and H_2S

D. The $\Delta_f G^\circ$ is negative for roasting of sulphide ore to oxide.

Answer: B

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22. In view of the signs of $\Delta_r G^\circ$ for the following reactions :

$PbO_2 + Pb \to 2PbO, \Delta_r G^\circ < 0$

$SnO_2 + Sn \to 2SnO, \Delta_r G^\circ > 0,$

which oxidation states are more characteristic for lead and tin ?

A. For lead $+4$, for tin + 2

B. For lead +2, for tin + 2

C. For lead +4, for tin +4

D. For lead +2, for in +4

Answer: D

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23. ΔG° vs T plot in the Ellingham's diagram slopes downward for the reaction

A. $Mg + \frac{1}{2}O_2 \rightarrow MgO$

B. $2Ag + \frac{1}{2}O_2 \rightarrow Ag_2O$

C. $C + \frac{1}{2}O_2 \rightarrow CO$

D. $CO + \frac{1}{2}O_2 \rightarrow CO_2$

Answer: C

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24. According to Ellingham diagram the oxidation reaction of carbon and carbon monoxide may be used to reduce which one of the following oxides at the lowest temperature?

A. Al_2O_3

B. Cu_2O

C. MgO

D. ZnO

Answer: B

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25. Which series of reactions correctly represents chemical rections related to iron and its compounds ?

A. $Fe \xrightarrow{O_2, \text{heat}} Fe_3O_4 \xrightarrow{CO, 600^\circ C} FeO \xrightarrow{CO, 700^\circ C} Fe$

B. $Fe \xrightarrow{\text{dil.} H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4, O_2} Fe_2(SO_4)_3$

C. $Fe \xrightarrow{O_2, \text{heat}} FeO \xrightarrow{\text{dil.} H_2SO_4} FeSO_4 \xrightarrow{\text{heat}} Fe$

D. $Fe \xrightarrow{Cl_2, \text{heat}} FeCl_3 \xrightarrow{\text{heat, air}} FeCl_2 \xrightarrow{Zn} Fe$.

Answer: A

Watch Video Solution

26. The following reaction take place in the blast in the proparation of impure iron identify the reaction pertatining to the formetion of the slag

A. $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$

B. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

C. $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$

D. $2C(s) + O_2(g) \rightarrow 2CO(g)$

Answer: C

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27. Identify the reaction that does not take place in a blast furnace

A. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

B. $CO_2 + C \rightarrow 2CO$

C. $CaCO_3 \rightarrow CaO + CO_2$

D. $FeO + SiO_2 \rightarrow FeSiO_3$

Answer: D

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28. which of the following electronts is present as the impurity to the maximum extent in the pig iron?

A. Phosphorus

B. Manganese

C. Carbon

D. Silicon

Answer: C

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29. When copper pyrites is roasted in excess of air, a mixture of $CuO + FeO$ is formed. FeO is present as impurity. This can be removed as slag during reduction of CuO. The flux added to form slag is

A. SiO_2, which is an acidic flux

B. limestone which is a basic flux

C. SiO_2, which is the basic flux

D. CaO, which is basic flux.

Answer: A

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30. Roasted copper pyrite on smelting with sand produces

A. $FeSiO_3$ as fusible slag and Cu_2S as matte

B. $CaSiO_3$ as infusible slag and Cu_2O as matte

C. $Ca_3(PO_4)_2$ as fusible slag and Cu_2S as matte

D. $Fe_3(PO_4)_2$ as infusible slag and Cu_2S as matte

Answer: A

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31. The composition of 'copper matte' is

A. $Cu_2S + FeS$

B. $Cu_2S + Cu_2O$

C. $Cu_2S + FeO$

D. $Cu_2O + FeS$

Answer: A

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32. Copper is extracted from copper pyrites by heating in a bessemer converter. The method is based on the principle that

A. iron has less affinity for oxygen then sulphur at high temperature.

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

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

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

Answer: D

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33. Heating mixture of $Cu_2O$and Cu_2S will give

A. $Cu + SO_2$

B. $Cu + SO_3$

C. $CuO + CuS$

D. Cu_2SO_3

Answer: A

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34. In the exteraction of copper from its sulphide ore, the metal is fanally obtained by the reduction of caprous oxide with

A. carbon monoxide

B. copper (I) sulphide

C. sulphur dioxide

D. iron (II) sulphide

Answer: B

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35. Extraction of zinc from zinc blende is achieved by

A. electrolytic reduction

B. roasting followed by reduction with carbon

C. roasting followed by reduction with other metal

D. roasting followed by self-reduction

Answer: B

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36. The method chiefly used for the extraction of lead and tin from there oras are respectrively .

A. Self reduction and Carbon reduction

B. Self reduction and Electrolytic reduction

C. Carbon reduction and Self reduction

D. Cyanide process and Carbon reduction

Answer: A

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37. The auto reduction process is not used in the metallurgy of

A. Hg

B. Cu

C. Pb

D. Fe

Answer: D

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38. Cryolite is:

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

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

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

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

Answer: D

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39. Aluminium is extracted from Alumina (Al_2O_3) by electrolysis of a molten mixture of

A. $Al_2O_3 + HF + NaAlF_4$

B. $Al_2O_3 + CaF_2 + NaAlF_4$

C. $Al_2O_3 + Na_3AlF_6 + CaF_2$

D. $Al_2O_3 + KF + Na_2AlF_6$

Answer: C

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40. In the correct of the Hall-Heroult process for the extraction of Al, which of the following statements is false ?

A. Al^{3+} is reduced at the cathode to form Al

B. Na_3AlF_6 serves as the electrolyte

C. CO and CO_2 are produced in this process

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

Answer: B

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41. The metal that cannot obtained by electrolysis of an aqueous solution of its salts is :

A. Cr

B. Ag

C. Ca

D. Cu

Answer: C

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42. In the alumino thermite process aluminium acts as

A. an oxidising agent

B. a flux

C. a reducing agent

D. a solder.

Answer: C

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43. Which of the following is used in thermine welding ?

A. $TiO_2 + 4Na \rightarrow Ti + 2Na_2O$

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

C. $SnO_2 + 2C \rightarrow Sn + 2CO$

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

Answer: B

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44. The process of isolation of metals by dissolving the ore in a suitable chemical reagent followed by precipitation of the metal by a more electropositive metal is called

A. Electrometallurgy

B. Hydrometallurgy

C. Electro - refining

D. Zone refining.

Answer: B

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

A. Na

B. Ag

C. Hg

D. Fe

Answer: D

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

Gold ore $\xrightarrow[CN^-, H_2O, O_2]{\text{Roasting}} HO^- + X \xrightarrow{Zn} Y + Au$

'X' and 'Y' are respectively

A. $Au(CN)_2^-$ and $Zn(CN)_4^{2-}$

B. $Au(CN)_4^{3-}$ and $Zn(CN)_4^{2-}$

C. $Au(CN)_3^-$ and $Zn(CN)_6^{4-}$

D. $Au(CN)_4^-$ and $Zn(CN)_3^-$

Answer: A

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47. Extraction of gold and silver involves leaching with CN^- ion.silver is later recovered by:

A. distillation

B. zone refining

C. displacement with Zn

D. liquation

Answer: C

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48. Extraction of chlrorine from brine solution is based on

A. acidification

B. reduction

C. oxidation

D. chlorination

Answer: C

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

A. cathode mud

B. anode mud

C. cathode

D. electrode

Answer: B

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50. During the process of electroytic 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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51. In zone-refining methode the molten zone

A. contains impurities

B. contains purified metal only

C. contains more impurity than the original metal

D. moves to either side.

Answer: C

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52. Match items of Column I with the items of Column II and assign the correct code:

$Column I$	$Column II$
(A) Cyanide process	(1) Ultrapure Ge
(B) Froth Floatation Process	(2) Dressing of ZnS
(C) Electrolytic reduction	(3) Extraction of Al
(D) Zone refining	(4) Extraction of Au
	(5) Purification of Ni

A. $\begin{matrix} A & B & C & D \\ (i) & (ii) & (iii) & (iv) \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ (iii) & (iv) & (v) & (i) \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ (iv) & (ii) & (iii) & (i) \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ (ii) & (iii) & (i) & (v) \end{matrix}$

Answer: C

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53. Which of the following pairs of metals uis purified by van arkel method?

A. Ni and Fe

B. Ga and In

C. Zr and Ti

D. Ag and Au

Answer: C

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54. Van Arkel method of refining zirconium involves

A. removing all oxygen and nitrogran impurites

B. removing CO impurity

C. removing hydrogen impurity

D. removing silica impurity

Answer: A

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55. Which method of purification is represented by the following equation?

$$Ti(s) + 2I_2(g) \xrightarrow{523K} Til_4(g) \xrightarrow{1700K} Ti(s) + 2I_2(g)$$

A. Cupellation

B. Poling

C. Van Arkel

D. Zone refining.

Answer: C

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56. Identify the alloy containing a non metal as a constituent in it

A. Invar

B. Steel

C. Bell metal

D. Bronze

Answer: B

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Competition Focus Jee Main And Advanced Medical Entrance Special Ii Multiple Choice Questions With One Or More Than One Correct Answers

1. Upon heating with Cu_2S , the reagent(s) that give copper metal is/are

A. $CuFeS_2$

B. CuO

C. Cu_2O

D. $CuSO_4$

Answer: B::C::D

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2. The carbon-based reduction method is NOT used for the extraction of

A. tin from SnO_2

B. iron from Fe_2O_3

C. aluminium from alumina

D. magnesium from $MgCO_3$. $CaCO_3$

Answer: C::D

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3. Extraction of metal from the ore cassiterite involves

A. carbon reduction of an oxides ore

B. self - reduction of a sulphide ore

C. removal of copper impurity

D. removal of iron impurity

Answer: A::C::D

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4. Electrolysis of brine gives

A. $NaOH$

B. O_2

C. Cl_2

D. H_2

Answer: A::C::D

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5. Copper is purified by electrolytic refining of blister copper. The correct statement(s) about this process is (are)

A. impure Cu strip is used as cathode

B. acidified $CuSO_4$ is used as electrolyte

C. pure Cu deposits at cathode

D. impurities settle as anode mud

Answer: B::C::D

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

A. crushing followed by concentration of the ore by froth - floatation

B. removal of iron as slag

C. self - reduction step of produce blister copper following evolution of SO_2

D. refining of blister copper reduction

Answer: A::B::C

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Competition Focus Jee Main And Advanced Medical Entrance Special Ii Multiple Choice Questions Comprehension

1. Extraction of copper is done using copper pyrites. After roasting, the ore is mixed with silica and coke and then smelted in a blast furnace. The matte obtained from the blast furnace is charged into a silica-lined converter. Some silica is also added, and a hot air blast is blown into the mixture to obtain blister copper, which is purified by electrorefining.

Coke is added during smelting to.

A. to reduce FeO to Fe

B. to reduce Cu_2O to Cu

C. to check the oxidation of FeO to Fe_2O_3

D. to check the oxidation of Cu_2O to CuO.

Answer: C

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2. Extraction of copper is done using copper pyrites. After roasting, the ore is mixed with silica and coke and then smelted in a blast furnace. The matte obtained from the blast furnace is charged into a silica-lined converter. Some silica is also added, and a hot air blast is blown into the mixture to obtain blister copper, which is purified by electrorefining.

The chemical composition of the slag formed during smelting is.

A. $CuSiO_3$

B. $FeSiO_3$

C. $CaSiO_3$

D. $Cu_2O.\ SiO_2$

Answer: B

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3. Copper is the most noble of first row transition metals and occurs in small deposits in serveral countries. Ores of copper include chalcanthite $(CuSO_4.5H_2O)$, atacanite $\left[Cu_2Cl(OH)_3\right]$, cuprite (Cu_2O), copper glance (Cu_2S), and malachite $\left[Cu_2(OH)_2CO_3\right]$. However, $80\,\%$ of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. The extraction of copper from chalcopyrite involves partial roasting, removal of iron and self-reduction.

Partial roasting of chalcopyrite produces

A. Cu_2S and FeO

B. Cu_2O and Fe O

C. CuS and Fe_2O_3

D. Cu_2O and Fe_2O_3

Answer: A

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4. Copper is the most noble of first row transition metals and occurs in small deposits in serveral countries. Ores of copper include chalcanthite $(CuSO_4.5H_2O)$, atacanite $\left[Cu_2Cl(OH)_3\right]$, cuprite (Cu_2O), copper glance (Cu_2S), and malachite $\left[Cu_2(OH)_2CO_3\right]$. However, $80\,\%$ of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. The extraction of copper from chalcopyrite involves partial

roasting, removal of iron and self-reduction.

Iron is removed from chalcopyrite as.

A. FeO

B. FeS

C. Fe_2O_3

D. $FeSiO_3$

Answer: D

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5. Copper is the most noble of first row transition metals and occurs in small deposits in serveral countries. Ores of copper include chalcanthite $(CuSO_4.5H_2O)$, atacanite $\left[Cu_2Cl(OH)_3\right]$, cuprite (Cu_2O), copper glance (Cu_2S), and

malachite $\left[Cu_2(OH)_2CO_3\right]$. However, $80\,\%$ of the world copper production comes from the ore chalcopyrite $(CuFeS_2)$. The extraction of copper from chalcopyrite involves partial roasting, removal of iron and self-reduction.

In self-reduction, the reducing species is.

A. S

B. O^{2-}

C. S^{2-}

D. SO_2

Answer: C

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Competition Focus Jee Main And Advanced Medical Entrance Special Iv Matching Type Questions

1. Match the entries of column I with appropriate entries of column II and choose the correct option but of the four options (a), (b), (c), (d) given at the end of each question.

	Column I		Column II
(A)	Siderite	(p)	Zinc
(B)	Chalcocite	(q)	Aluminium
(C)	Calamine	(r)	Copper
(D)	Bauxine	(s)	Iron

A. A-s, B- r, C-p, D-q

B. A-p, B-s, C-r, D-q

C. A-q, B-r, C-s, D-p

D. A-r, B-q, C-p,D-s

Answer: A

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2. Match the entries of column I with appropriate entries of column II and choose the correct option but of the four options (a), (b), (c), (d) given at the end of each question.

	Column I		Column II
(A)	Zone refining	(p)	Titanium
(B)	Mond's process	(q)	Lead
(C)	Liquation	(r)	Nickel
(D)	van - Arkel	(s)	Germanium

A. A-r, B-p, C-s, D-q

B. A-s, B-r, C-q, D-p

C. A-s, B-q, C-r, D-p

D. A-q, B-s, C-p, D-r

Answer: B

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Competition Focus Jee Main And Advanced Medical Entrance Special V Matrix Matching Type Questions

1. 

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Competition Focus Jee Main And Advanced Medical Entrance Special Vi Integer Type Questions

1. Amongst the following, total number of metals which occur in the native state in the earth's crust are : Fe, Zn, Na, Au, Ni, Sb, Sn, Pt, Hg.

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2. Amongst the following, oxide ores are : calamine, fools's gold, cuprite zincite, chalcocite, haematite, bauxite, magnetite, cassiterite

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3. Amongst the following , the total number of ores which may be concentrated by froth floatation process is : haematite, bauxite, galena, copper pyrites, sphalerite, cassiterite, calamine, argentite , chalocite.

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4. Amongst the followings the ores which are roasted to convert them into their corresponding metal oxides are :

alumina, zinc blende, iron pyrites, copper pyrites, calamine, galena, chalcocite.

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5. How many of the following metals can be refined by vapour phase refining ?

$Zn, Zr, Hg, Cd, Ni, Ti, Co, Pt, Fe.$

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Competition Focus Jee Main And Advanced Medical Entrance Special Vii Assertion Reason Type Questions Type I

1. (A) All minerals are ores

(R) Ores are minerals from which metal can be extracted

convenitly and economically

A. Statement - 1 is True, Statement - 2 is True, Statement - 2 is correct explanation of Statement -1.

B. Statement - 1 is True , Statement - 2 is not a correct explanation of Statement - 1.

C. Statement - 1 is True, Statement - 2 is False.

D. Statement - 1 is False, Statement - 2 is True.

Answer: D

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2. Statement - 1 : Standard free energy of formation $\left(\Delta_f G^\circ\right)$ for Al_2O_3 and Cr_2O_3 at 1273 K are - 827 kJ mol^{-1} of O_2 and $-540kJmol^{-1}$ of O_2 respectively.

Statement - 2 : Al can reduce Cr_2O_3 to Cr since, $\Delta_r G^\circ$ is negative.

A. Statement - 1 is True, Statement - 2 is True, Statement - 2 is correct explanation of Statement -1.

B. Statement - 1 is True , Statement - 2 is not a correct explanation of Statement - 1.

C. Statement - 1 is True, Statement - 2 is False.

D. Statement - 1 is False, Statement - 2 is True.

Answer: A

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3. During reduction of ZnO to Zn, C is more efficient than CO. The standard free energy of formation of CO_2 from CO is

always higher than that of ZnO.

A. Statement - 1 is True, Statement - 2 is True, Statement - 2 is correct explanation of Statement -1.

B. Statement - 1 is True , Statement - 2 is not a correct explanation of Statement - 1.

C. Statement - 1 is True, Statement - 2 is False.

D. Statement - 1 is False, Statement - 2 is True.

Answer: B

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4. Metals of high purity are obtained by zone refining.

Impurities are more soluble in melt in pure metal.

A. Statement - 1 is True, Statement - 2 is True, Statement - 2 is correct explanation of Statement -1.

B. Statement - 1 is True , Statement - 2 is not a correct explanation of Statement - 1.

C. Statement - 1 is True, Statement - 2 is False.

D. Statement - 1 is False, Statement - 2 is True.

Answer: A

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

Reason: Impurities present in nickel form volatile compounds.

A. Statement - 1 is True, Statement - 2 is True, Statement - 2 is correct explanation of Statement -1.

B. Statement - 1 is True , Statement - 2 is not a correct explanation of Statement - 1.

C. Statement - 1 is True, Statement - 2 is False.

D. Statement - 1 is False, Statement - 2 is True.

Answer: C

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Competition Focus Jee Main And Advanced Medical Entrance Special Vii Assertion Reason Type Questions Type Ii

1. Assertion. Gold and platinium occur in native state.

Reason. Gold and platinium are not attacked by moisture, oxygen and carbon dioxide of the atmosphere.

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

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: A

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2. Assertion. Carbonate and hydroxide ores are concentrated by froth floatation process.

Reason. In froth floatation process, mineral oil is used because it perferentially wets the gangue particles.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: D

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3. Assertion: Ag and Au are extracted by leaching the ores with a dilute solution of $NaCN$.

Reason: Impurities associated with these ores dissolve in $NaCN$.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: C

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4. Assertion. The reduction of a metal oxide is easier if the metal formed is in the liquid state.

Reason. $\Delta_f G^\circ$ of metal oxides increases with temperature.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: B

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5. Assertion. Both C and CO can reduce FeO to Fe but at temperatures above 1073 K it is C which is a better reducing agent than CO while below 1073 K, it is CO which is a better reducing agent than C.

Reason. Above 1073 K, $\Delta_f G^\circ$ for CO from C is more negative than that of FeO from Fe while below 1073 K, $\Delta_f G^\circ CO_2$ from CO is more negative that that of FeO from Fe.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the 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. Aluminothermy is used for extraction of chromium from chromium oxide.

Reason. Alumina reacts with carbon to from aluminium carbide which decomposes at high temperature to from Al while carbon is oxidised to CO.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: B

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7. Assertion. Al is obtained by high temperature reduction of alumina with carbon.

Reason. Alumina reacts with carbon to form aluminium carbide which decomposes at high temperature to from Al while carbon is oxidised to CO.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: D

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8. Assertion : Al_2O_3 is converted into Al by reduction with carbon at high temp.

Reason : Carbon has greater affinity for oxygen than aluminium.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: D

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9. Ti can be purified by Van Arkel process.

TiI_4 is a volatile compound which decomposes at a high temperature.

A. If both assertion and reason are true, and reason is not the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true, but reason is false

D. If both assertion and reason are false

Answer: A

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Important Questions For Board Examination

1. What is a mineral? How does it differ from an ore?

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2. Copper and silver lie below hydrogen in electrochemical series and yet they are found in the combined state as sulphides in nature. Comment.

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3. What is fool's gold ?

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4. What type of ores concentrated by electromagnetic separation ? Give three examples of such ores.

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5. (a) Why is it that only sulphide ores are concentrated by froth floatation process ?

or Why is the froth floatation process selected for the concentrated of sulphide ores ?

(b) Which of the following ores can be concentrated by froth floatation method and why ?

Fe_2O_3, ZnS, Al_2O_3

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6. Name a sulphide ore which is not concentrated by froth floatation process. Why is it so ?

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7. A sample of galena is contaminated with zinc blende. Name one chemical which can be used to concentrate galena selectively by froth floatation method.

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

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9. Why is it advantageous to roast a sulphide ore to the oxide before reduction ?

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10. Giving examples differentiate between roasting and calcination.

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11. Suggest a condition unders which magnesium could reduce alumina.

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12. How is cas iron different from pig iron ?

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

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

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15. (a) During roasting most of the metals are converted into their respective oxides which are then reduced to the corresponding metals by using suitable reducing agents. However, it has been seen that in some cases, instead of the metal oxide, it is the metal which is isolated.

Read the above passage and answer the following questions :

(i) Name two metal sulphides which are converted into the corresponding metals during roasting. When does it happen so ?

(ii) Name two metal sulphides which get converted into the corresponding metals during roasting. When does it happen so ?

(b) What is a flux ? What is the role of a flux in teh metallurgy of iron and copper ?

(c) How is wrought iron different from steel ?

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16. What is the principle of thermite process ? Name two meals which can be extracted with the help of this process.

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17. Write a non - exothermic reaction takind place in the blast furnace during extraction of iron.

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18. Write down the reactions taking place in Blast furnace related to the metallurgy of iron in the temperature range 500 - 900 K.

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19. What is a slag ? Give one example.

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20. How is copper extracted from a low grade ore of it ?

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21. Which of the following metals cannot be extracted by the smelting process ? Explain

Al, Zn, Fe, Pb

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

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23. Both iron and aluminium combine slowly with oxygen at room temperature. Why is this reaction a problem for iron but not for aluminium?

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24. Why is an external emf of more than $2.2V$ required for the extraction of CI_2 from brine?

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25. Suggest one method for separation of nickel form cobalt ?

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26. Discuss the chemistry of the following reagents in the refining of metals. (i) CO and (ii) I_2

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27. Write the composition, one property and one use of each of the following alloys :

aluminium bronze, brass, stainless steel

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Curiosity Questions

1. Usually a broken iron article is taken to the welding shop for repair. But it is difficult to take broken girders or the craked railway track to the industry for repair. Can the welding equipment be brought to the site for repair ? Name the process, illustrate the principle of its working and name some other practicle applications of this process.

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2. Iron articles usually rust within few years. But since 400 A.D the Delhi iron piller Near Kutab Minar is existing without any rust or sign of decay. Explain how ?

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