CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

GENERAL PRINCIPLES AND PROCESS OF ISOLATION OF ELEMENTS

Illustration

1. Give examples of (a) igneous and (b) sedimentary rocks. What is the origin of (a) igneous rocks and (b) sedimentary rocks ?

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2. (a) In general, which metals are expected to occur in the native state in nature ?

(b) A certain metal M occurs in three compounds namely X, Y and Z. X has $15\,\%$ of M, Y has $66\,\%$ of M and Z has $71\,\%$ of M. If we extract M from X, Y and Z, it costs $Rs.\,35perkg$, $Rs.\,45perkg$ and $Rs.\,100perkg$ respectively. Out of X, Y and Z which material can be considered as an ore of M ?

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3. 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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4. (1) Metals occur in the native form because of their

(a) High electronegativity

(b) Low reactivity

(c) Low density

(d) High reactivity

(2) Specific gravity of slag is

(a) Higher than molten metal

(b) Same as that of molten metal

(c) Less as that of molten metal

(d) None of the above

(3) Which process is used for the extraction of metals from their sulphide ores ?

(a) Smelting

Froth flotation

(c) Electrolysis

(d) Metal displacement

(4) Calamine is an ore of

(a) Hg

(b) Zn

(c) Ca

(d) Cd

(5) Non-fusible impurities of ores removed by adding

Slag

(b) Flux

(c) Gangue

(d) None

(6) Common method of extraction of metals from oxide ore involves.

(a) Reduction with aluminium

(b) Reduction with carbon

Reduction with hydrogen

(d) Electrolytic method

(7) Smelting is the reduction of oxide to metal by

(a) Carbon

(b) Hydrogen

(c) Aluminimum

(d) Electric current

During froth flotation process, commonly used frother is.

(a) $CuSO_4$

(b) $NaCN + alkali$

(c) Pine oil

(d) Potassium xanthate

(9) Iron ores are dressed by

(a) Froth flotation process

(b) Hand picking

(c) Magnetic separation

(d) All of the above

(10) Silicon is the main constituent of

(a) Alloys

(b) Rocks

(c) Animals

Plants.

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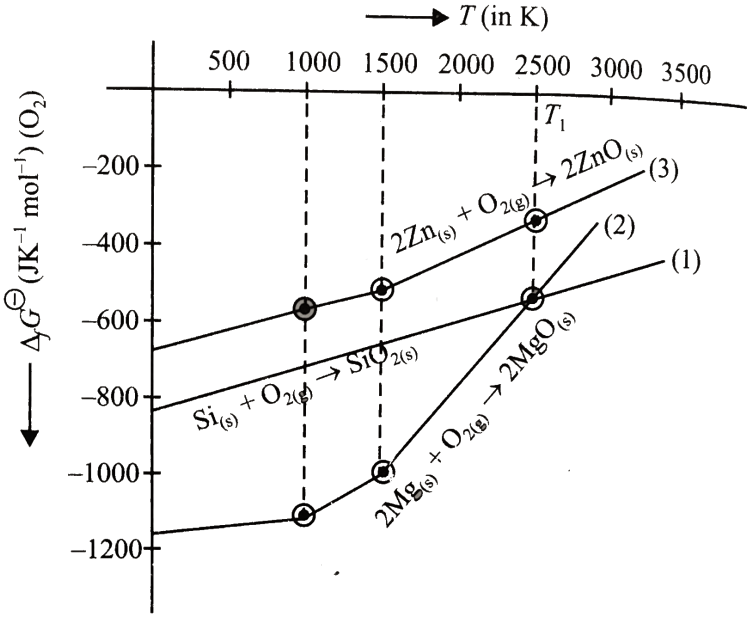
5. Interpret the following Ellingham diagram.



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6. (a) Suggest a condition under which magnesium could reduce alumina.

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

(c) What is the reduction of a metal oxide easier if the metal formed is in liquid state at the temperature of reduction ?

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

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

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8. (a) What is a slag ?

(b) Give the principle of zone refining ?

(c) An ore sample of galena (PbS) is contaminated with zinc blende (ZnS). Give an example of a chemical which can be used to concentrate galena selectively by froth flotation process.

(d) What is meant by the term 'Pyrometallurgy' ?

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

(b) Define flux.

(c) Metal usually do not occur in nature as nitrates. Why ?

(d) Metal such as Cu, Ag, Zn etc. occur in nature as sulphide rather than oxides. Why ?

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10. (a) Which of the following metals cannot be extracted by the smelting process ?

Al, Zn, Fe and Pb.

(b) Graphide is used as anode but not diamond. Give reason.

(c) Give a method for separation of nickel from cobalt ?

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Solved Example

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

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

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

$\Delta_f G^{\ominus}\left(MgO_{(s)}\right) = -941kJ/molat1273K$

$\Delta_f G^{\ominus}\left(MeO_{(s)}\right) = -314kJ/molat2273K$

$\Delta_f G^{\ominus}\left(CO_{(g)}\right) = -439kJ/molatat1273K$

$\Delta_f G^{\ominus}\left(CO_{(g)}\right) = -628kJ/molat2273K$

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

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

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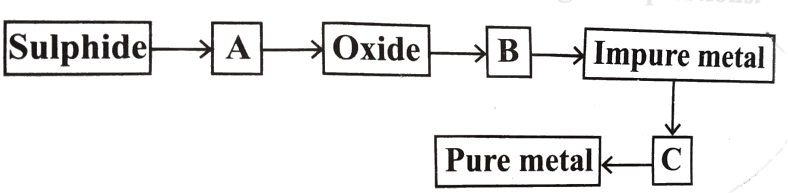
6. From the following flowsheet for the extraction of pure metal, answer the given questions.



(i) Step A is :

A. Roasting

B. Smelting

C. Calcination

D. Bessemerisaion

Answer: A

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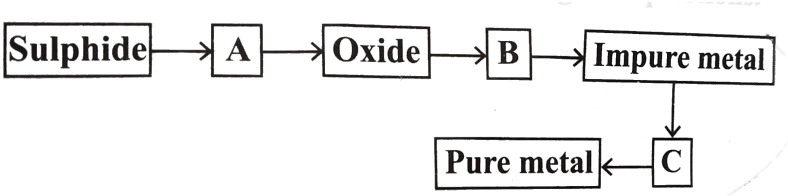
7. From the following flowsheet for the extraction of pure metal, answer the given questions.



(ii) Step B (reduction) can be carried out ny using :

A. Carbon

B. More electropositive element

C. Both of these

D. None of these

Answer: C

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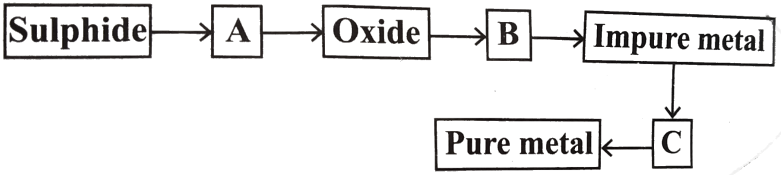
8. From the following flowsheet for the extraction of pure metal, answer the given questions.



(iii) Impure Cu metal is also obtained :

A. By self-reduction during roasting of CuS

B. By reduction of CuO with H_2

C. By reduction of CuO with Al

D. By electrolysis of Cu^{2+} solution

Answer: A::B

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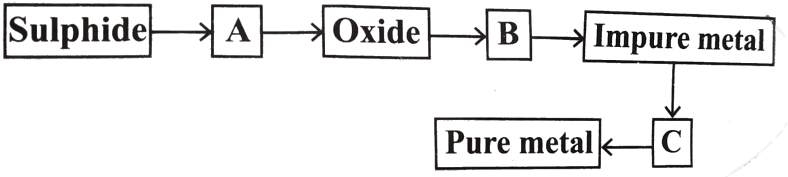
9. From the following flowsheet for the extraction of pure metal, answer the given questions.



(iv) Some of the following metals are obtained by electrolysis of their fused salts : Al, Na, Cu, Ag, Mg, Ca. These metals are :

A. Cu, Ag

B. Al, Na, Cu

C. Ag, Mg, Ca

D. Al, Na, Mg, Ca

Answer: D

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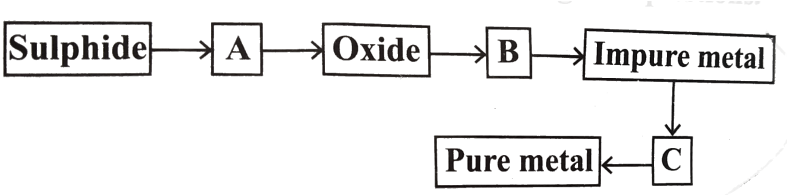
10. From the following flowsheet for the extraction of pure metal, answer the given questions.



(v) Reduction of oxides to elements with carbon generally takes place at high temperature, hence Al is used in aluminothermite process. It is because :

A. Al is more electropositive than the other metals (to be formed by reduction).

B. Al has maximum affinity for oxygen.

C. Reduction is highly exothermic, and the heat liberated makes the process spontaneous.

D. Reduction is highly endothermic, and the heat absorbedmakes the process spontaneous.

Answer: A::C

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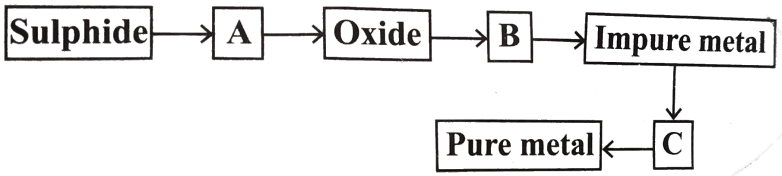
11. From the following flowsheet for the extraction of pure metal, answer the given questions.



(vi) following reaction is not involved intermite process :

A. $3Mn_3O_4 + 8Al \rightarrow 9Mn + 4Al_2O_3$

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

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

D. $B_2O_3 + 2Al \rightarrow 2B + Al_2O_3$

Answer: C

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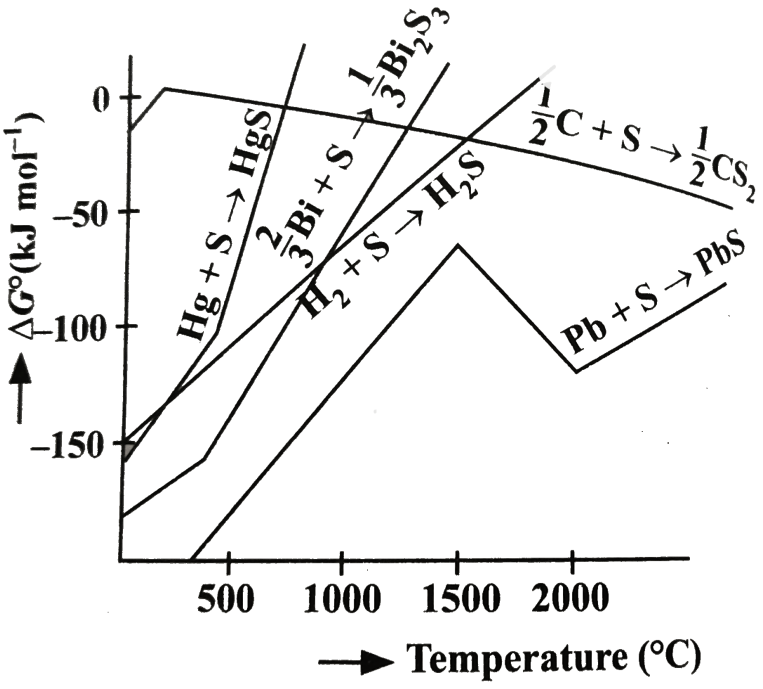
12. The Ellingham diagram for a number of metallic sulphides is reproduced below.



Answer the questions given below :

(i) Formation of which of the sulphidesis not spontaneous ?

A. HgS

B. Bi_2S_3

C. PbS

D. CS_2

Answer: A

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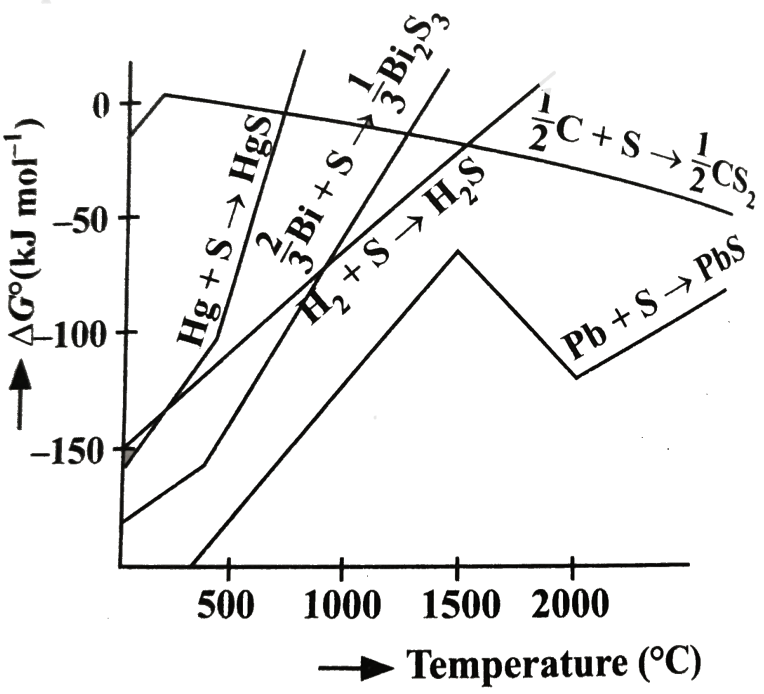
13. The Ellingham diagram for a number of metallic sulphides is reproduced below.



Answer the questions given below :

(ii) Which occurs to minimum extent in nature ?

A. HgS

B. H_2S

C. Bi_2S_3

D. CS_2

Answer: A::C

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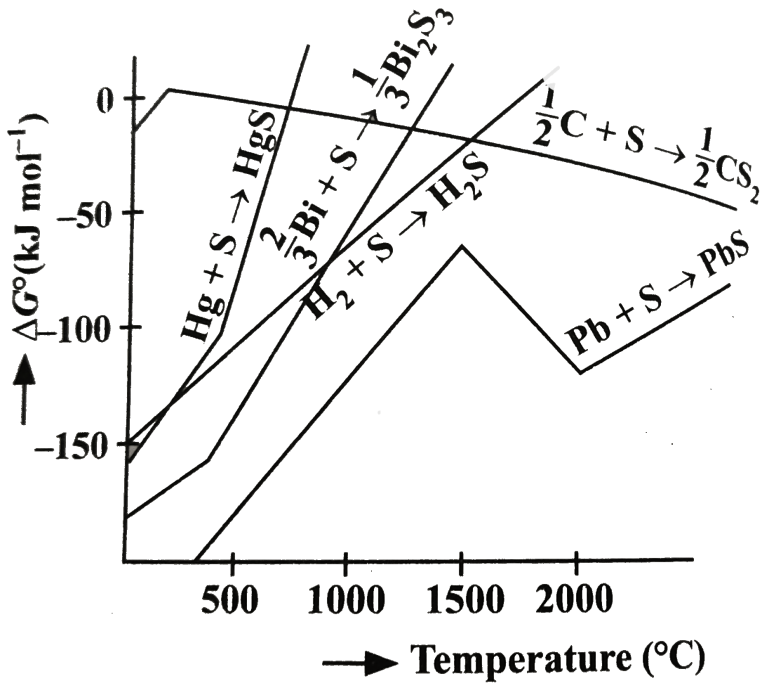
14. The Ellingham diagram for a number of metallic sulphides is reproduced below.



Answer the questions given below :

(iii) Which of the following sulphides can be reducted to metal by H_2 at about $1000K$?

A. HgS

B. PbS

C. Bi_2S_3

D. All of these

Answer: D

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15. Questions given below are based on the given diagram for extractive metallurgy.

(i) At what approximate temperature, zinc and carbon have equal affinity for oxygen ?

A. $1000^{\circ} C$

B. $1500^{\circ} C$

C. $500^{\circ} C$

D. $1200^{\circ} C$

Answer: A

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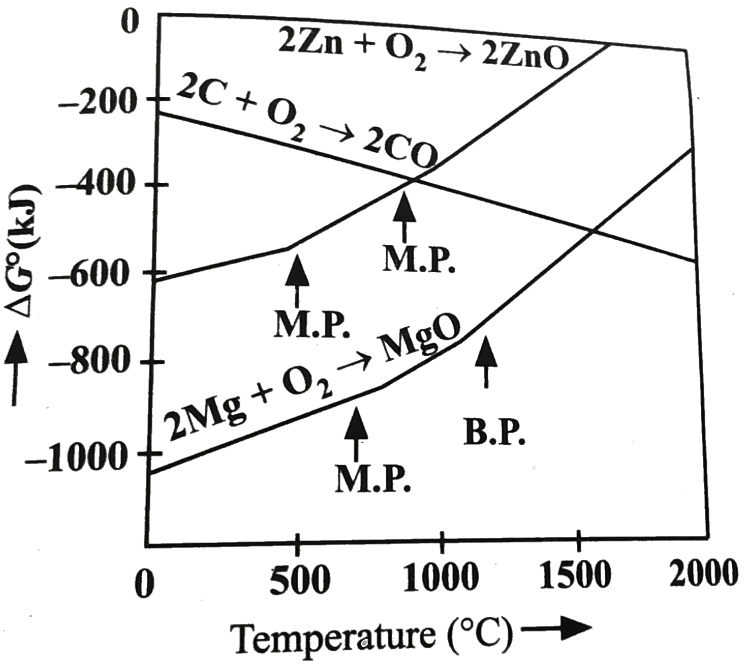
16. Questions given below are based on the given diagram for extractive metallurgy.

(ii) At this temperature $\Delta_f G^{\ominus}$ of the reaction is

$ZnO + C \rightarrow Zn + CO.$



A. $-ve$

B. $+ve$

C. Zero

D. Nothing can be said

Answer: C

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17. Questions given below are based on the given diagram for extractive metallurgy.

(iii) The make the following process spontaneous, temperature should be :

$ZnO + C \rightarrow Zn + CO.$

A. $< 1000^{\circ} C$

B. $> 1100^{\circ} C$

C. $< 500^{\circ} C$

D. $> 500^{\circ} C \text{ but } < 1000^{\circ} C$

Answer: D

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18. Questions given below are based on the given diagram for extractive metallurgy.

(iv) At $1100^{\circ}C$, which reaction is spontaneous to a maximum extent ?

A. $MgO + C \rightarrow Mg + CO$

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

C. $MgO + Zn \rightarrow Mg + ZnO$

D. $ZnO + Mg \rightarrow MgO + Zn$

Answer: D

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19. Questions given below are based on the given diagram for extractive metallurgy.

(v) This method is known as :

A. Pyrometallurgy

B. Parametallurgy

C. Hydrometallurgy

D. Semimetallurgy

Answer: A

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20. At high temperature, carbon reacts with water to produce a mixture of CO and H_2.

$C + H_2O \xrightarrow{\text{Heat heat}} CO + H_2$

CO is separated from H_2 and then used to separate Ni from CO by forming a volatile compound, nickel tetracarbonyl $\left(Ni(CO)_4\right)$.

$Ni + 4CO \rightarrow Ni(CO)_4$

(a) Formation of volatile $Ni(CO)_4$ and its subsequent heating give pure Ni. Name the process involved.

(b) How many moles of $Ni(CO)_4$ could be obtained from CO produced by the reaction of $75.0g$ is carbon ?

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21. $A \xrightarrow{\text{Calcination}} CaO + MgO + \underset{\text{Colourless gas}}{(B)}$

When the colourless gas (B) is passed through lime water, initially a milky solution is obtained and on excess passage of gas (B) through the lime water, milkiness disappears.

(A) is :

A. $CaCO_3$

B. $MgCO_3$

C. $CaCO_3.MgCO_3$

D. $CaSO_4.MgCO_3$

Answer: C

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22. $A \xrightarrow{\text{Calcination}} CaO + MgO + \underset{\text{Colourless gas}}{(B)}$

When the colourless gas (B) is passed through lime water, initially a milky solution is obtained and on excess passage of gas (B) through the lime water, milkiness disappears.

(B) is.

A. CO_2

B. SO_2

C. CO

D. SO_3

Answer: A

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23. $A \xrightarrow{\text{Calcination}} CaO + MgO + \underset{\text{Colourless gas}}{(B)}$

When the colourless gas (B) is passed through lime water, initially a milky solution is obtained and on excess passage of gas (B) through the lime water, milkiness disappears.

Name of the product (A) is :

A. Dolomite

B. Limenstone

C. Magnesite

D. Malachite

Answer: A

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24. $A \xrightarrow{\text{Calcination}} CaO + MgO + \underset{\text{Colourless gas}}{(B)}$

When the colourless gas (B) is passed through lime water, initially a milky solution is obtained and on excess passage of gas (B) through the lime water, milkiness disappears.

Lime water is.

A. CaO

B. $CA(OH)_2$

C. $CaCO_3$

D. $CaCO_3 . Ca(OH)_2$

Answer: B

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25. $A \xrightarrow{\text{Calcination}} CaO + MgO + \underset{\text{Colourless gas}}{(B)}$

When the colourless gas (B) is passed through lime water, initially a milky solution is obtained and on excess passage of gas (B) through the lime water, milkiness disappears.

Milkiness of lime water solution disappears due to the formation of :

A. $CaCO_3$

B. $Ca(HCO_3)_2$

C. $Ca(OH)_2$

D. $CaCl_2$

Answer: B

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Exs 1.1 (Subjective)

1. Why is Fe an abundant element on earth, and why are the elements with higher atomic number increasingly rare ?

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

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4. Which methods would you recommed for the purification of impure metals such as zinc. Copper and germanium metals ?

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5. Name the chief forms of the occurrence of the following in the earth's crust :

(a) Aluminium

(b) Calcium

(c) Sodium

(d) Lead

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6. Discuss some of the factors which need consideration before deciding on the method of extraction of metal from its ore.

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7. 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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8. Which is a better reducing agent at $710^{\circ} C: C$ or CO ?

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

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10. Is it true that under certain conditions, Mg can reduce SiO_2, and Si can reduce MgO ?

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

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12. name three metals which are obtained by the reduction of their oxides though they do not occur as such in the eacth's crust.

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13. 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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14. 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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15. How do non-metals occur in nature ? How are they extracted//isolated from their natural sources ?

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16. Name the chief ores of tin, iron and aluminium. What methods are employed for the concentration or purification of their ores ?

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17. Name three ores which are concentrated by froth flotation process. What is a depresent ?

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18. What is the thermodynamic consideration in the choice of a reducing agent in metallurgy ?

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19. Carbon monoxide is more effective reducing agent than carbon below $983K$ but above this temperature, the reverse is true. How would you explain this ?

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20. Describe the principle of extraction of each of the following :

(a) Sn from SnO_2

(b) Zn frin ZnO

(c) Cr from Cr_2O_3.

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

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22. Name the main steel plants which are operated by the Steel Authority of India.

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23. Name the metals which are associated with the following terms in their extraction from their ores :

(a) Bessemer's converter

(b) Blast furnace

(c) Aluminityhermic process

(d) Magnetic separation.

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24. What do you understand by the following terms ?

(a) Roasting

(b) Calcination

(c) Smelting.

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25. Which method would you suggest for the separation of the metals in the following mixtures ?

(a) Zinc and iron

(b) Copper and magnesium

(c) Rare earths

Give reasons for your choice.

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Exs 1.1 (Objective)

1. Choose the correct option :

(i) Gold is exracted using :

A. Amalgamation process

B. Carbon reduction process

C. Electrolytic process

D. Oxidation process

Answer: A

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2. (ii) Carbon reduction is used for the extraction of :

A. Fe

B. K

C. Al

D. None of these

Answer: A

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3. (iii) Which is not a basic flux ?

A. $CaCO_3$

B. CaO

C. SiO_2

D. None of these

Answer: C

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4. (iv) Metallurgy is the process of :

A. Concentrating the ore

B. Roasting of the ore

C. Additing carbon to the ore

D. Extracting the metal from the ore

Answer: D

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5. (v) An essential constituent of analgam is :

A. Hg

B. Ag

C. Au

D. Al

Answer: A

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6. (vi) Which element is purified by zone refining ?

A. Ge

B. Si

C. Sn

D. Ni

Answer: A::B

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7. (vii) Which element is found in human body ?

A. Fe

B. Mg

C. Ca

D. Al

Answer: A::C

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8. (viii) Amongest the following groups of oxides, the group containing oxides that cannot be reducing by carbon to give the respective metals is.

A. Cu_2O, SnO_2

B. Fe_2O_3, ZnO

C. CaO, K_2O

D. PbO, Fe_3O_4

Answer: C

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9. (ix) Slag coming out at the bottom of a blast furance during extraction of iron form its ore is used in making.

A. Fertiliders

B. Roads

C. Plastics

D. Glass moulds

Answer: B

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10. (x) Regions in which metals are found in earth is called

A. Lithophile

B. Atmophile

C. Calcophile

D. Siderophile

Answer: A

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11. (xi) While furnace can be used to get temperature above $3000^{\circ} C$?

A. Blast furnace

B. Reverberatory furnace

C. Arc furnace

D. None of the above

Answer: C

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12. (xii) Which is known as 'blister copper' ?

A. Pure copper

B. $98\ \%$ copper

C. Alloy of copper

D. Ore of copper

Answer: B

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13. (xiii) Which process represents the change,

$Ti + 2I_2 \rightarrow TiI_4 \rightarrow Ti + 2I_2$?

A. Zone refining

B. Mond's process

C. Van Arkel method

D. Poling

Answer: C

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

$$\underset{\text{Impure}}{Ni} + 4CO \xrightarrow{320K} Ni(CO)_4 \xrightarrow{420K} \underset{\text{Pure}}{NO} + 4CO.$$

A. Mond's process

B. Van Arkel method

C. Zone refining

D. Cupellation

Answer: A

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Exs 1.1 (True Orfalse Statement)

1. True or false statements :

(i) Sodium cyanide is used as a depresent to separate lead sulphide from zinc sulphide.

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2. (ii) Iron can reduce alumina to aluminium metal.

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3. (iii) Substances which convert infusible impurities present in ores into fusible substances during smeting are called slag.

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4. (iv) Zirconium is best refined by zonc refining method.

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5. (v) Impurties are more soluble in the melt than in the solid state of the metal.

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6. (vi) In Bessenmerisation of sulphide ore of copper, there is self-reduction giving copper metal.

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7. (vii) Mercury is transported on containers made of iron.

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8. (viii)The ore $CuFeS_2$ is used to extract iron metal.

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9. (ix) It is possible to extract a metal from its oxide it the free energy of formation of the oxide of the reducing agent is lower than that of the oxidising agent.

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10. Fill in the blanks :

(a) Pig iron in manufactured by using ___ furnace.

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11. (b) Platinum, indium etc. are known as noble metals because they are ___towards many common reagents.

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12. (c) ___iron is the purest form of iron.

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13. (d) Passivity of iron is due to the formation of thin film of ___on its surface.

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14. (e) Phenimenon of removing layers of basic oxides from metals before electroplating is called _____.

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15. (f) In the manufacture of iron from haematite, limestone is added to act as _____.

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16. (g) An ore of tin containing $FeCrO_4$ is concentrated by ____.

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17. (h) In froth process, the ore particles float because their surface is ____.

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18. Coating of zinc on iron objects is commonly known as _____.

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19. In electrorefining, the impure metal is made _____.

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Exercises (Linked Comprehension)

1. 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 FeO

C. Cu_2O and Fe_2O_3

D. CuS and Fe_2O_3.

Answer: A

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2. 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

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Iron is removed from chalcopyrite as.

A. FeO

B. FeS

C. Fe_2O_3

D. $FeSiO_3$

Answer: D

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3. Copper is the most noble 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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4. 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 formula of copper pyrites is.

A. $CuFeS_2$

B. Cu_2O

C. Cu_2S

D. $CuCO_3.Cu(OH)_2$

Answer: A

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5. 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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6. 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. Reduce FeO to Fe

B. Reduce Cu_2O to Cu

C. Check the oxidation of FeO to Fe_2O_3

D. Check the oxidation of Cu_2O to CuO.

Answer: A

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7. 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.

Matte is a mixture of

A. $Cu_2S + FeS$ (small amount)

B. $FeS + Cu_2S$ (small amount)

C. $Cu_2O + FeO$ (small amount)

D. $FeO + Cu_2S$ (small amount)

Answer: A

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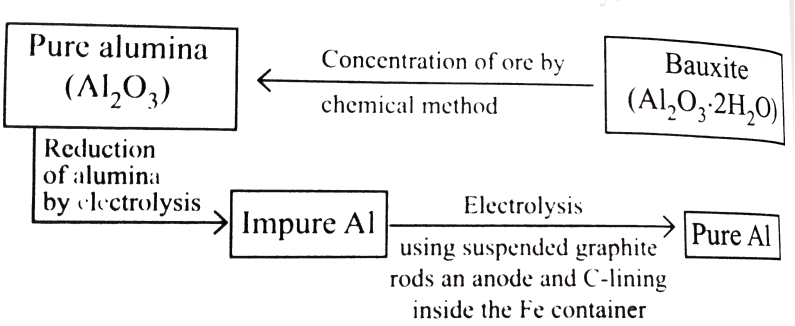
8. Extraction of aluminium can be understood by :



Electrolytric reduction of Al_2O_3 :

Electrolysis : $Al_2O_3 + Cryolite + CaF_2$

Cathode : Carbon inside the Fe container

Anode : Graphite rods.

The purpose of adding cryolite is.

A. To remove the impurities as slag

B. To lower the melting point of Al_2O_3

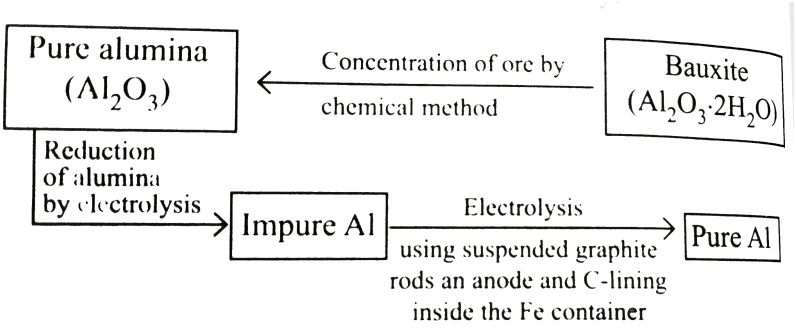
C. To decrease the electrical conductivity of pure aluminium

D. To increase the Al percentage in the yield

Answer: B

Watch Video Solution

9. Extraction of aluminium can be understood by :



Electrolytric reduction of Al_2O_3 :

Electrolysis : $Al_2O_3 + Cryolite + CaF_2$

Cathode : Carbon inside the Fe container

Anode : Graphite rods.

Coke power is spread over the molten electroltyte to.

A. Prevent the corrosion of graphite anode

B. Prevent the heat radiation form the surface

C. Prevent the oxidation of molten aluminium by air

D. Both (a) and (b)

Answer: D

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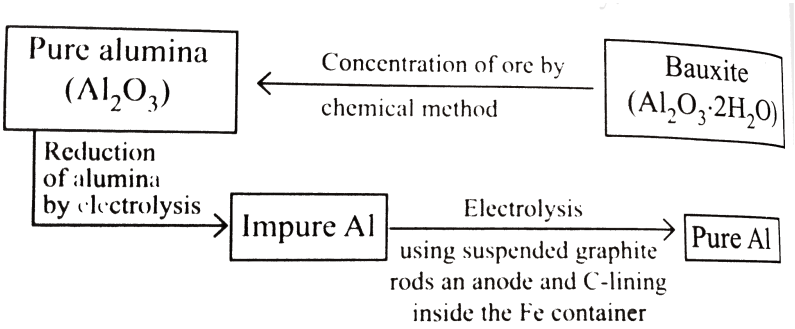
10. Extraction of aluminium can be understood by :



Electrolytric reduction of Al_2O_3 :

Electrolysis : $Al_2O_3 + Cryolite + CaF_2$

Cathode : Carbon inside the Fe container

Anode : Graphite rods.

The function of fluorspar (CaF_2) is.

A. To increase the melting point of electrolyte

B. To increase electrolytic conductivity power

C. To remove the impurities as slag

D. All of these

Answer: B

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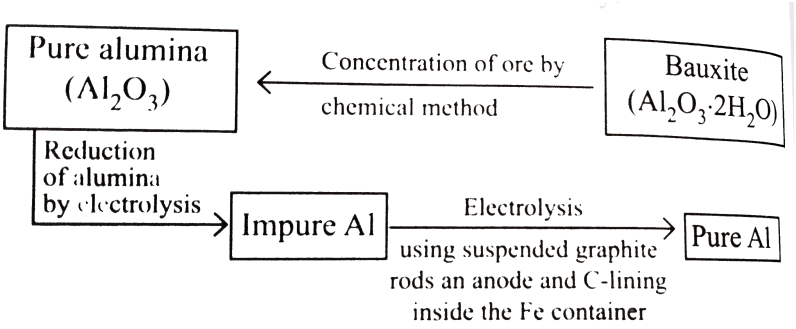
11. Extraction of aluminium can be understood by :



Electrolytic reduction of Al_2O_3 :

Electrolysis : $Al_2O_3 + Cryolite + CaF_2$

Cathode : Carbon inside the Fe container

Anode : Graphite rods.

The motion electrolytes contain $Na^{\oplus}$, Al^{3+} and Ca^{2+} but only Al gets deposited at cathode because,

A. Standard reduction potential of Al of more than that of Na and Ca

B. Standard oxidation potential of Al is more than that of Na and Ca

C. Graphite reacts only with Al^{3+} and not with $Na^{\oplus}$ and Ca^{2+} .

D. Discharge potential of Al^{3+} is higher than $Na^{\oplus}$ and Ca^{2+}.

Answer: A

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12. Roasting is a process in which the ore (mostly sulphide) is heated strongly in the presence of excess of air. The heating should be done at a temperature below the melting point of the ore.

Select of correct statement :

A. Roasting removes easily oxidisable volatile impurities like arsenic as As_2O_3, antimony as Sb_2O_3, and sulphur as SO_2.

B. The release of SO_2 (in roasting process) has been a serious air pollution problem.

C. In roasting process, if temperature is fairly low (about $500^\circ C$) and the concentration of SO_2 in the gaseous enviourment is more, sulphate may be produced, that is stable, and high temperature is needed to decompose it.

D. All are correct

Answer: D

Watch Video Solution

13. Roasting is a process in which the ore (mostly sulphide) is heated strongly in the presence of excess of air. The heating should be done at a temperature below the melting point of the ore.

$2PbS + 3O_2 \rightarrow A + 2SO_2$

The name of A is.

A. Litharge

B. Galena

C. Sesquioxide

D. None of these

Answer: A

Watch Video Solution

14. Roasting is a process in which the ore (mostly sulphide) is heated strongly in the presence of excess of air. The heating should be done at a temperature below the melting point of the ore. Sometimes roasting may not bring about complete oxidation :

$2CuFeS_2 + 4O_2 \rightarrow A + 2FeO + 3SO_2$

Find the A :

A. Cu_2O

B. CuO

C. Cu_2O

D. CuS

Answer: C

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15. Lead obtained form galena (PbS) by air reduction or carbon reduction process contains base metal (Cu, Bi, Sn, As) as impurities, due to the which lead becomes hard and brittle.

Parke's process is also called.

A. Softening process

B. Desilverisation method

C. Cupellation

D. None of these

Answer: B

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16. Lead obtained form galena (PbS) by air reduction or carbon reduction process contains base metal (Cu, Bi, Sn, As) as

impurities, due to the which lead becomes hard and brittle.

Cupellation is used for purification of

A. Pb

B. Ag

C. Zn

D. Fe

Answer: B

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17. Lead obtained form galena (PbS) by air reduction or carbon reduction process contains base metal (Cu, Bi, Sn, As) as impurities, due to the which lead becomes hard and brittle.

Ag can be obtained form purified $Zn - Ag$ alloy by

A. Distillation

B. Poling

C. Liquation

D. Reduction

Answer: A

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18. Lead obtained form galena (PbS) by air reduction or carbon reduction process contains base metal (Cu, Bi, Sn, As) as impurities, due to the which lead becomes hard and brittle.

$Zn - Ag$ alloy formed in the upper layer of molten lead is skimmed off from the surface of the molten lead by perforated ladles. This alloy contains lead as impurity. This impurity of Pb is removed by

A. Distillation

B. Cupellation

C. Liquation

D. Bett's electrolysis

Answer: C

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19. Lead obtained from galena ore (PbS) by air reduction or carbon reduction process contains base metal (cu, Bi, As, Sn, Zn) as impurities.

The removal of the impurity of Ag from the commercial lead is called.

A. Desilverization of lead

B. Softening process

C. Bett's electrolysis

D. Cupellation

Answer: A

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20. Lead obtained from galena ore (PbS) by air reduction or carbon reduction process contains base metal (cu, Bi, As, Sn, Zn) as impurities.

The removal of the impurity of Ag from the commercial lead is called.

A. $PbSO_4 + H_2SO_4$

B. $PbCl_2 + HCl$

C. $PbSiF6 + H_2SiF_6$

D. None of these

Answer: C

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21. Lead obtained from galena ore (PbS) by air reduction or carbon reduction process contains base metal (cu, Bi, As, Sn, Zn) as impurities.

Gelatin acts as addition agent in electrolysis of Pb. In the presence of gelatin, Pb becomes.

A. Hard and brittle

B. Soft and useless

C. Smooth and uniform

D. Only brittle

Answer: C

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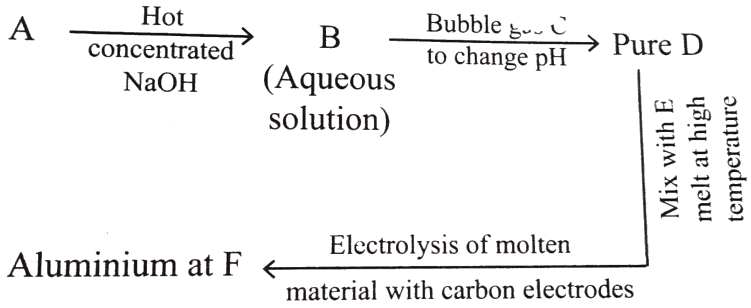

22.

A is.

A. $CuFeS_2$

B. $MgCl_2.6H_2O$

C. $Al_2O_3.2H_2O$

D. CuS

Answer: C

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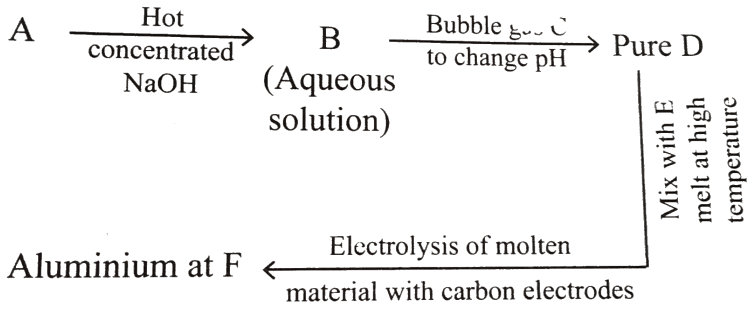

23.

B is :

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

B. $NaOH$

C. H_2SO_4

D. Al_2O_3

Answer: A

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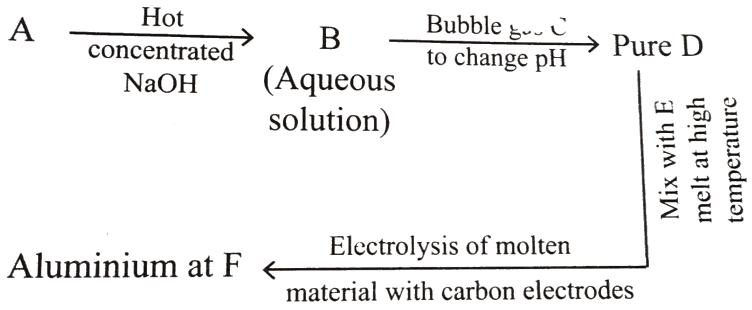

24.

C is.

A. CO_2

B. SO_2

C. SO_3

D. NO_2

Answer: A

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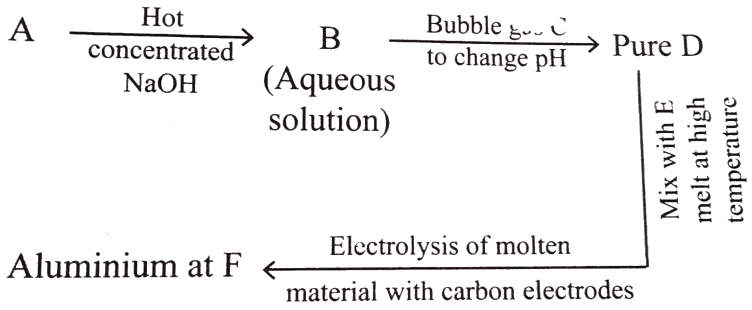

25.

E is.

A. Na_3GeF_6

B. Na_3AlF_6

C. Al_2O_3

D. None of these

Answer: B

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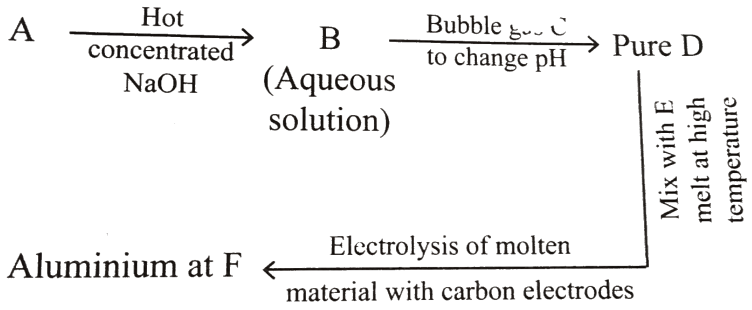

26.

F is.

A. Cathode

B. Anode

C. Electrolyte

D. None of these

Answer: A

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27. $\underset{(\text{Sulphide ore})}{A} + NaCN \overset{\text{Air}}{\Longleftrightarrow} \underset{(\text{Complex})}{B} + Na_2S \xrightarrow{O_2} C.$

A is.

A. As_2S

B. CuS

C. Na_2S

D. HgS

Answer: A

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28. $\underset{(\text{Sulphide ore})}{A} + NaCN \overset{\text{Air}}{\Longleftrightarrow} \underset{(\text{Complex})}{B} + Na_2S \xrightarrow{O_2} C.$

Composition of B is.

A. $Na\left[Ag(CN)_2\right]$

B. $Na_2\left[Ag(CN)_2\right]$

C. $Na\left[Ag(CN)_4\right]$

D. $Na_3\left[Ag(CN)_2\right]$

Answer: A

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29. $\underset{(\text{Sulphide ore})}{A} + NaCN \overset{\text{Air}}{\Longleftrightarrow} \underset{(\text{Complex})}{B} + Na_2S \xrightarrow{O_2} C.$

B is.

A. Ferromagnetic

B. Paramagnetic

C. Linear complex

D. Coordinate number of central atom is 4

Answer: B::C

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30. $\underset{(\text{Sulphide ore})}{A} + NaCN \overset{\text{Air}}{\Longleftrightarrow} \underset{(\text{Complex})}{B} + Na_2S \xrightarrow{O_2} C.$

C is.

A. Na_2SO_4

B. Na_2SO_3

C. Na_2O

D. Na_2O_2

Answer: A

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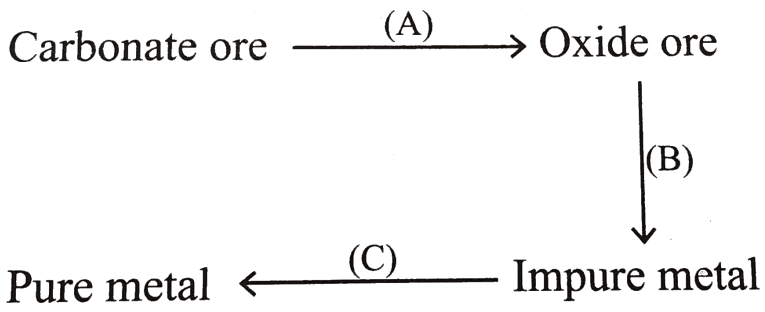

31.

Name the process (A)

A. Roasting

B. Smelting

C. Calcination

D. Reduction

Answer: C

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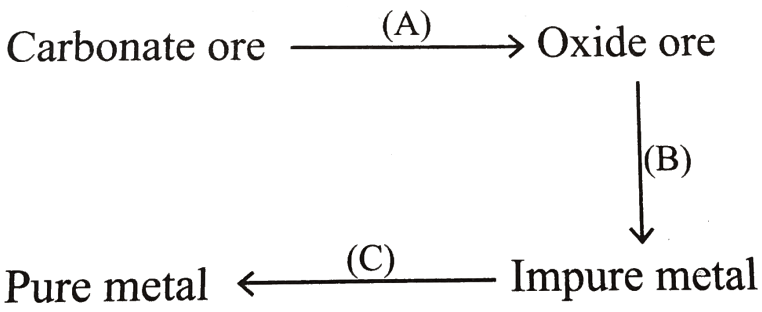

32.

Name the process (B).

A. Reduction

B. Roasting

C. Mond's process

D. Van Arkel process

Answer: B

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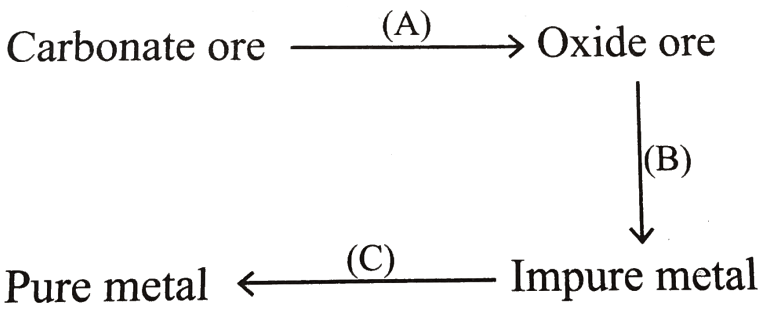

33.

Name the process (C)

A. Reduction

B. Zone-refining

C. Roasting

D. Calcination

Answer: B

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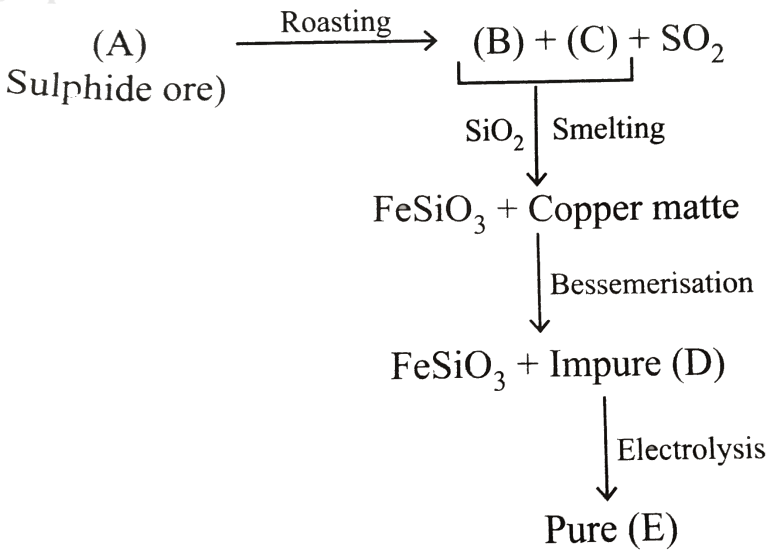

34.

Identify (A).

A. CuS

B. FeS_2

C. $CuFeS_2$

D. Fe_3O_4

Answer: C

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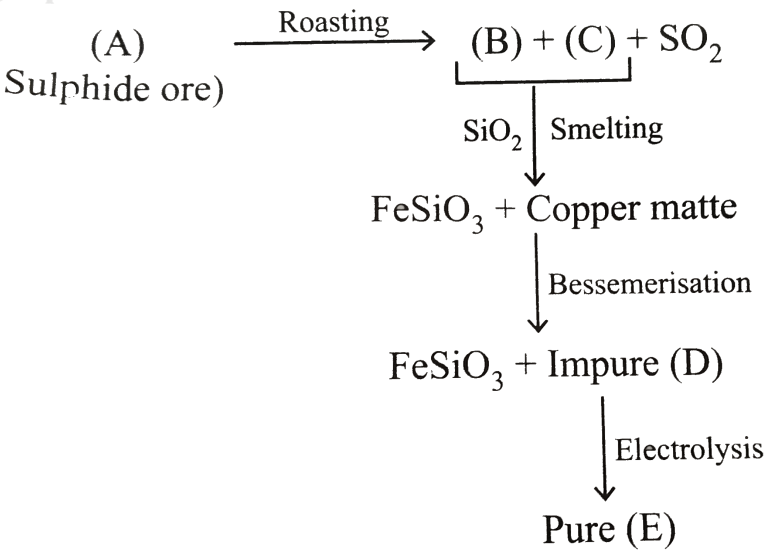

35.

Identify (B) and (C) :

A. $FeS + FeO$

B. $FeO + Cu_2S$

C. $FeS + Cu_2O$

D. $Cu_2O + Cu_2S$

Answer: B

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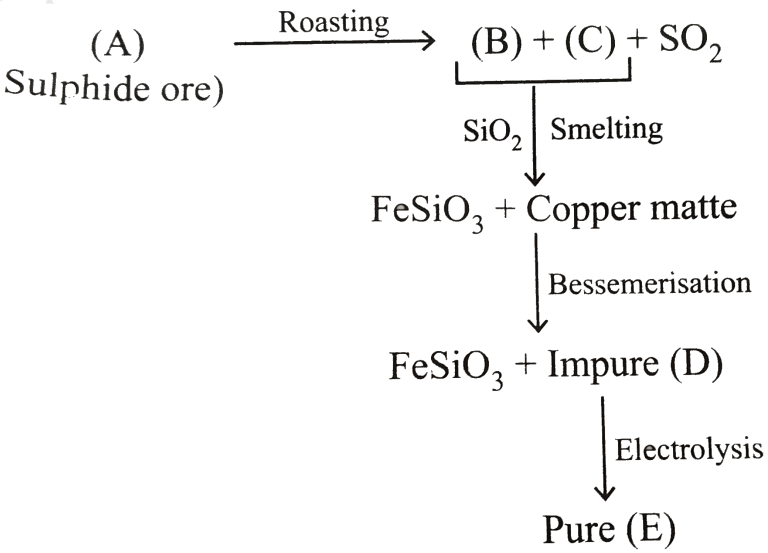

36.

Composition of copper matte is.

A. $Cu_2S + FeS$ (small amount)

B. $Cu_2S + FeS$ (small amount)

C. $Cu_2 + FeSO_4$ (small amount)

D. $Cu_2S + FeO$ (small amount)

Answer: A

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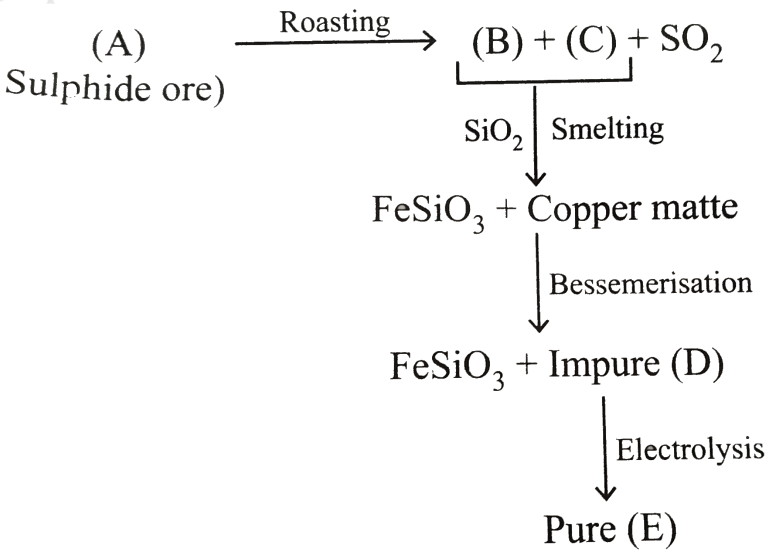

37.

Identify (E).

A. Bilser Cu

B. Blister Cu

C. Pig iron

D. FeO

Answer: A

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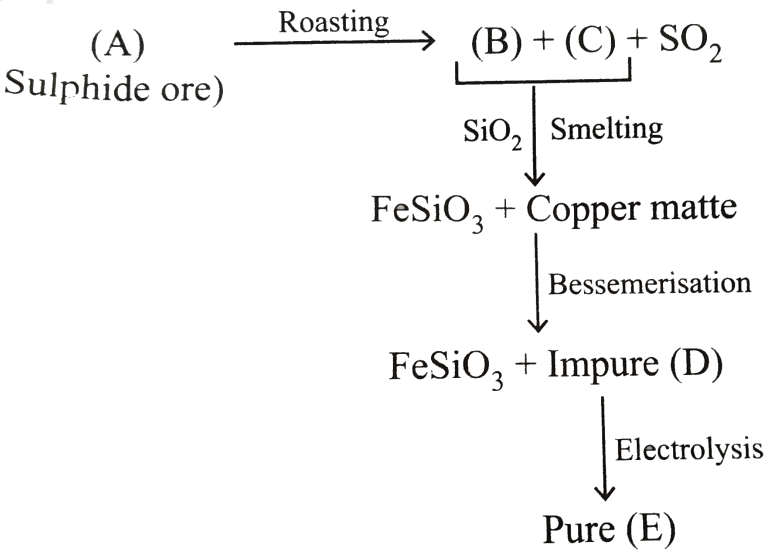

38.

Pure (E) is

A. Cu

B. Fe

C. S

D. O_2

Answer: A

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39. Chief ore of Zn is ZnS. The ore is concentrated by froth flotation process and then heated in air to convert ZnS to ZnO.

Itntgt $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$...(i)

ZnO, thus formed is treated with dilute H_2SO_4.

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ ....(ii)

On electrolysis of $ZnSO_{4(aq)}$, Zn metal is produced.

$2ZnSO_4 + H_2O \rightarrow 2Zn + 2H_2SO_4 + O_2$....(iii)

What mass of Zn will be obtained from an ore containing $225kg$ of ZnS ? $(Zn = 65, S = 32, O = 16, H = 1)$.

A. 102 kg

B. 151 kg

C. 112 kg

D. 134 kg

Answer: B

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40. Chief ore of Zn is ZnS. The ore is concentrated by froth flotation process and then heated in air to convert ZnS to ZnO.

ltntgt $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$...(i)

ZnO, thus formed is treated with dilute H_2SO_4.

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ ....(ii)

On electrolysis of $ZnSO_{4(aq)}$, Zn metal is produced.

$2ZnSO_4 + H_2O \rightarrow 2Zn + 2H_2SO_4 + O_2$....(iii)

ZnO on dissolution in $NaOH$ gives

A. Na_2ZnO_2

B. $NaZnO_2$

C. $NaZn(OH)_4$

D. $NaZn_2O_3$

Answer: A

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41. Chief ore of Zn is ZnS. The ore is concentrated by froth flotation process and then heated in air to convert ZnS to ZnO.

ltntgt $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$...(i)

ZnO, thus formed is treated with dilute H_2SO_4.

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ ....(ii)

On electrolysis of $ZnSO_{4(aq)}$, Zn metal is produced.

$2ZnSO_4 + H_2O \rightarrow 2Zn + 2H_2SO_4 + O_2$....(iii)

How many kilomoles of $NaOH$ are required to dissolve all the ZnO produced in reaction (ii) ?

A. 1.16

B. 2.32

C. 4.64

D. 9.28

Answer: C

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42. Chief ore of Zn is ZnS. The ore is concentrated by froth flotation process and then heated in air to convert ZnS to ZnO.

ltntgt $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$...(i)

ZnO, thus formed is treated with dilute H_2SO_4.

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ ....(ii)

On electrolysis of $ZnSO_{4(aq)}$, Zn metal is produced.

$2ZnSO_4 + H_2O \rightarrow 2Zn + 2H_2SO_4 + O_2$....(iii)

What volume of $98\,\%$ H_2SO_4 (by weight, density $= 1.8g/mL$) is required in step (ii) ?

A. 120 L

B. 129 L

C. 1.40 L

D. 150 L

Answer: B

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Exercise (Multiple Correct)

1. The anode mud obtained during electrorefining of copper may contain.

A. Iron

B. Magnesium

C. Silver

D. Gold

Answer: C::D

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2. Liquation process may be applied for the purification of.

A. Copper

B. Tin

C. Iron

D. Lead

Answer: B::D

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3. Carnallite is an ore of

A. Sodium

B. Potassium

C. Magnesium

D. Aluminium

Answer: B::C

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4. Which is (are) not an ore ?

A. Bauxite

B. Zinc blende

C. Pig iron

D. Wrought iron

Answer: C::D

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5. $Ca_3(PO_4)_2$ is :

A. Thomos slag

B. Used in cement manufacturing

C. Used in manufacture of phosphorus fertiliser

D. Used as a refractory meterial

Answer: A::B::C

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6. Metal (s) which does/do not form amalgam is/are :

A. Fe

B. Zn

C. Ni

D. Au

Answer: A::C

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7. Metallury involves steps :

A. Cencentration of ore

B. Reduction of ore

C. Purification

D. Alloy formation

Answer: A::B::C

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8. Which of the following ore is/are oxide ore (s) ?

A. Cassiterite

B. Bauxite

C. Cryolite

D. Haematite

Answer: A::C::D

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9. Which of the following are correct processes ?

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

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

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

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

Answer: B::C::D

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10. Which of the following are correctly matched ?

A. Malachite : $CuCO_3.Cu(OH)_2$

B. Chalcopyrite : $CuFeS_2$

C. Copper glane : Cu_2S

D. Azurite : Cu_2O

Answer: A::B::C

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11. Auto-reduction process is used for the extraction of :

A. Cu

B. Hg

C. Pb

D. Al

Answer: A::B::C

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12. Which of the following reactions occurs during calcination ?

A. $CaCO_3 \rightarrow CaO + CO_2$

B. $2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$

C. $4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$

D. $Cu_2S + 2CuO \rightarrow 4Cu + SO_2$

Answer: A::B

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13. Leaching can be used for extraction of

A. Pb

B. Al

C. Ag

D. Au

Answer: A::B::D

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14. MgO can be used as a refractory material because

A. It is a good electrical insulator

B. It is a good conductor of heat

C. It has high melting point

D. None of the above

Answer: A::B::C

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15. Salt which is (are) least likely to find in minerals

A. Acetate

B. Nitrate

C. Chloride

D. Sulphate

Answer: A::B

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16. The etraction of metals from oxide ores involves

A. Reduction with carbon

B. Reduction with aluminium

C. Electrolytic reduction

D. Reduction with CO

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

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17. 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. ZnO

B. Al_2O_3

C. CuO

D. MgO

Answer: B::D

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18. Which of the following statements are correct regarding metallurgy of iron ?

A. Coke reduces FeO to Fe above $1073K$

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

C. Coke reduces Fe_2O_3 to FeO above $1073K$

D. Coke reduces Fe_2O_3 to FeO above $1073K$.

Answer: A::B

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19. The major role of flourspar, CaF_2 which is added in small amount in the electrolytic reduction of Al_2O_3 dissolved on fused cryolite in fused cryolite is

A. To increase the conductivity of the fused mixture

B. To lower the fusion temperature of the melt

C. To act as catalyst

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

Answer: A::B

Watch Video Solution

20. Which is correct process-mineral group in metallurgical extraction ?

A. Leaching : Ag

B. Van Arkel : Zr

C. Liquation : Sn

D. Zone refining : Sn

Answer: A::B::C

Watch Video Solution

21. Tempering of steel

A. Increases mechanical strength

B. Changes ration of iron in steel

C. Involves heating the steel to appropriate temperature and then cooling it rapidly

D. Decreases mechanical strength

Answer: A::C

Watch Video Solution

22. Out of the following reduction processes :

(i) $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$

(ii) $Cu_2O + C \rightarrow 2Cu + CO$

(iii) $PbO + C \rightarrow Pb + CO$

(iv) $ZnO + C \rightarrow Zn + CO$

Correct process is//are :

A. (i)

B. (ii)

C. (iii)

D. (iv)

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

Watch Video Solution

23. Out of the following matals that cannot be obtained by electrolysis of the aquenous solution of their salts is

A. Ag

B. Mg

C. Au

D. Na

Answer: A::C

Watch Video Solution

24. Silver containing lead as an impurity is not purified by

A. Poling

B. Cupellation

C. Levigation

D. Distillation

Answer: A::C::D

Watch Video Solution

Watch Video Solution

25. Select the correct statements for Ellingham diagram.

A. The slope of the curves of the formation of metal oxide is $+ve$ because $\Delta_f G^{\ominus}$ becomes less negative or increases with the rise in temperature.

B. Each curve is a straight line except when some change takes place in phase $(s \to 1 \text{ or } 1 \to g)$

C. Each curve is not a straight line except when some changes takes place in phase $(s \to 1 \text{ or } 1 \to g)$.

D. The slope of the curves of the formation of metal oxide is $-ve$ becomes less negative or increases with the rise in temperature.

Answer: B::D

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26. Which of the following statements is/are correct ?

A. The chemical processes in the production of steel from haematite ore involve reduction followed by oxidation.

B. Lead is extracted from its chief ore galena by both carbon reduction as well as self-reduction.

C. In Hall-Heroult process, the electrolyte used is a molten mixture of alumina and cryolite or fluorspar.

D. Haematite, cassiterite and argentite are oxide ores.

Answer: A::B::C

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27. Which of the following pairs consists of ore the same metal ?

A. Magnesite, cerussite

B. Chalcocite, copper pyrites

C. Bauxite, corundum

D. Anglesite, cerussite

Answer: B::C::D

Watch Video Solution

28. Which of the following metal oxides are reduced by self-reduction method ?

A. Cu_2O

B. PbO

C. HgO

D. CaO

Answer: A::B::C

Watch Video Solution

29. Disadvantages of using carbon as a reducing agent :

A. High temperature is needed

B. Many metals combine with carbon to form carbides

C. Low temperature is needed

D. Many metals combine with carbon and do not form carbides

Answer: A::B

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30. Select the correct statements :

A. Based on reactivity series, occurrence of certain elements takes place in native state.

B. Due to the basic nature of oxides of alkaline earth metals, they combine with atmospheric acidic oxides giving salts.

C. Based on reactivity series, occurrence of certain of elements takes place in atomic state.

D. None of correct

Answer: A::B

Watch Video Solution

31. Froth flotation process used for the concentration of sulphide ore.

A. Is based on the difference in wettability of different minerals.

B. Uses sodium ethyl xanthate, $C_2H_5OCS_2Na$, as collestor

C. Used $NaCN$ as depressant in the mixture of ZnS and PbS when ZnS forms soluble complex and PbS forms froth

D. Uses pine oil as frothing agent

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

Watch Video Solution

32. Which of the following steps are involved in hydrometallurgical process ?

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

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

C. $Ag_2S + 2NaCN \rightarrow \left[Ag(CN)_2\right]^{\ominus} + Na_2S$

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

Answer: B::C::D

Watch Video Solution

33. The reduction of an oxide by aluminium is not called

A. Ellingham process

B. Goldschmidt's aluminothermite process

C. Kroll's process

D. Van Arkel process

Answer: A::C::D

Watch Video Solution

34. For the pyrometallurgical method used for the extraction of copper from sulphide ore, which statements is//are correct ?

A. Pyrometallurgy is a dry method

B. It involves concentration by leaching the sulphide ore with dil. H_2SO_4.

C. It involves concentration of the sulphide ore by froth flotation process

D. It involves concentration by leaching for every ore.

Answer: A::C

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35. In Fe extraction, the roasting is carried out because

A. All FeO be converted to Fe_2O_3

B. The formation of $FeSiO_3$ slag is prevented

C. Fe_2O_3 does not react with SiO_2 to0 from slag

D. The formation of slag $(CaSiO_3)$ is enhanced.

Answer: A::B::C

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36. Select the correct statements (Ellingham diagram) :

A. When temperature is raised, a point will be reached where the graph crosses the $\Delta_f G^{\Theta} = 0$ line. Below this temperature, the free energy of formation of the oxide is negative, so the oxide is stable

B. When the temperature is raised, a point will be reached where the graph crosses the $\Delta_f G^{\Theta} = 0$ line. Above this temperature, the free energy of formation of the oxide is positive, and the oxide becomes instable, and should decompose into the metal and dioxygen.

C. Theoretically, all oxides can be decomposed to give the metal and dioxygen if a sufficiency high temperature can be attained.

D. Theoretically, all oxides cannot be decomposed to give the metal and dioxide if a sufficiently high temperature can be attained.

Answer: A::B::C

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37. Select the correct statements for Ellingham diagram.

A. Any metal will reduce the oxide of other metals which lie about it in the Ellingham diagram

B. According to Ellingham diagram, Al will not reduce MgO at temperature below $1350^\circ C$.

C. According to Ellingham diagram, Al will reduce MgO at temperature below $1350^\circ C$.

D. Any metal will not reduce the oxide of other metals which lie above it in Ellingham diagram.

Answer: A::B

Watch Video Solution

38. The extraction of metals from sulphide ore involves

A. Reduction with carbon

B. Froth flotation

C. Reduction with Al

D. Electrolytic reduction

Answer: A::B

Watch Video Solution

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

A. Reversible nature of reaction between Ag_2S and $NaCN$

B. Oxidised Na_2S formed into Na_2SO_4

C. Irreversible nature of reaction between Ag_2S and $NaCN$

D. None of above

Answer: A::B

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40. In the commercial extraction of iron, roasting is adopted because

A. It removes impurities of S, As and Sb in the form of their elemental vapour

B. It prevents slag formation by Fe_2O_3

C. It prevents slag formation by FeO

D. Limonite is converted into its anhydrous form

Answer: C::D

Watch Video Solution

41. Select the correct statements :

A. In hydrometallurgy, Zn is used as oxidising agent in the purification of Ag from $\left[Ag(CN)_2\right]^{\ominus}$.

B. When pine oil or eucalyptus oil is added into the water, it lowers down the surface tension by which froth is formed.

C. Sodium ethyl xanthate is used as collector

D. Basic copper carbonate or $PbSO_4$ is concentrated by froth flotation method by using an activator.

Answer: B::C::D

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42. Select the correct statements for calcination :

A. Carbonate ore is converted in oxide ore

B. Hydrated oxide ore is converted into its oxide ore

C. Oxidisable volatile impurities are removed by calcination process

D. Only calcination occurs for carbinate or oxide ore

Answer: A::B

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43. H_2 is not widely used as the reducing agent in metallurgical process because

A. Many metals react with H_2 at elevated temperature forming hydrides

B. There is risk of explosion from H_2 and O_2 present in the air

C. Reducing power of H_2 does not increase with temperature

D. Reducing power of H_2 increases with temperature.

Answer: A::B::C

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Exercise (Single Correcttype)

1. The impurities associated with the ore after mining are collectively called

A. Flux

B. Slag

C. Minerals

D. Gangue

Answer: D

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2. An ore after levigation is found to have acidic impurities. When of the following can be used as flux during smelting operation ?

A. H_2SO_4

B. $CaCO_3$

C. SiO_2

D. Both $CaCO_3$ and SiO_2

Answer: B

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3. The rocks formed by the solidification of magma over the years are

A. Igneous rocks

B. Sedimentary rocks

C. Metamorphic rocks

D. None of these

Answer: A

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4. The process in which metal oxide is reduced to metal by Al is called

A. Smelting

B. Aluminothermy

C. Hydrothermy

D. No specific name

Answer: B

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5. Extraction of silver from Ag_2S by the use of sodium cyanide is example of

A. Roasting

B. Hydrometallurgy

C. Electrimetallurgy

D. Smelting

Answer: B

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6. Which of the following metals can be extracted by smelting ?

A. Aluminium

B. Magnesium

C. iron

D. None of these

Answer: C

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7. The most abundant element in earth's crust is

A. Nitrogen

B. Oxygen

C. Iron

D. Magnesium

Answer: B

Watch Video Solution

8. Which of the following processes involve the roasting process ?

A. $ZnCO_3 \rightarrow ZnO + CO_2$

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

C. $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$

D. $Al_2O_3.2H_2O \rightarrow Al_2O_3 + 2H_2O$

Answer: C

Watch Video Solution

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9. Alklali metals do not exist in free state in nature because these are

A. Very reactive

B. Very volatile

C. Metallic in nature

D. Highly electronegative elements

Answer: A

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10. 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

11. Salt which is (are) least likely to find in minerals

A. Chloride

B. Sulphate

C. Sulphide

D. Nitrate

Answer: D

Watch Video Solution

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

A. Froth flotation

B. Leaching

C. Liquation

D. Magnetic separation

Answer: B

Watch Video Solution

13. In the aluminothermite process, aluminium is

A. Oxidising agent

B. Flux

C. Reducing agent

D. Solder

Answer: C

Watch Video Solution

14. Magnetic separation is used for increasing concentration of the following

A. Horon silver

B. Calcite

C. Haematite

D. Magnesite

Answer: C

Watch Video Solution

15. Which of the following srtatement above the advantage of masting of sulphide are before reduction is not true?

A. $\Delta_f G^{\Theta}$ of the sulphide is greater than CS_2 and H_2S.

B. $\Delta_f G^{\Theta}$ is negative for roasting of sulphide ore to oxide

C. Roasting of the sulphide to oxide is thermodynamically feasible

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

Answer: D

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16. When the sample of copper with zinc impurityn is to be purified by electrolysis, the appropriate electrode are .

A. Cathode : Pure Zn

Anode : PureCu

B. Cthode : Impure sample

Anode : Pure Cu

C. Cathode : Impure Zn

Anode : Impure sample

D. Cathode : Pure Cu

Anode : Impure sample

Answer: D

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17. 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

Watch Video Solution

18. On heating a mixture of Cu_2O and Cu_2S, we get :

A. $Cu + SO_2$

B. $Cu + SO_3$

C. $CuO + CuS$

D. Cu_2SO_3

Answer: A

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19. Sulphide ore of metal are usually concentrated by froth flotation process .Which one of the following sulphide3 ores after an exception and is contrated by electrical leaching?

A. Galena

B. Copper pyrite

C. Sphalerite

D. Argenitite

Answer: D

Watch Video Solution

20. Heating of ore in presence of air to remove sulphure impurities is called

A. Calcination

B. Roasting

C. Smelting

D. None of these

Answer: B

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21. The method of zone relining of metal is based on the principle of $AIFMIT-2003)$

A. Greater solubility of the impurities in the molten state than in the solid

B. Greater solubility of pure metal than that of impurity

C. Higher melting point of the impurity than that of pure metal

D. Greater noble character of the solid metal than that of the impurity

Answer: A

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22. Which of the following function 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 than CS_2

B. Metal sulphides are thermodynamically more stable than CS_2

C. CO_2 is thermodynamically more stable than CS_2

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

Answer: B

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23. Complex formation for cyanide method is used for the extraction of

A. Cu

B. Fe

C. Hg

D. Ag

Answer: D

Watch Video Solution

24. The least stable oxide at room temperature is

A. ZnO

B. CuO

C. Sb_2O_3

D. Ag_2O

Answer: D

Watch Video Solution

25. High purity copper metal is obtained by

A. Carbon reduction

B. Hydrogen reduction

C. Electrolytic reduction

D. Thermite process

Answer: C

Watch Video Solution

26. Corumdum is

A. SrO_2

B. Al_2O_3

C. $CaCl_2$

D. Cu_2Cl_2

Answer: B

Watch Video Solution

27. Whch ore can be best concentrated by froth flotation process ?

A. Malachite

B. Cassiterite

C. Galena

D. Manetite

Answer: C

Watch Video Solution

28. The metal extracted by leaching with cyanide is

A. Mg

B. Ag

C. Cu

D. Na

Answer: B

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29. When MnO_2 is fused woth KOH, a coloured compound is formed, the product and its colour are

A. K_2MnO_4, purple green

B. $KMnO_4$, purple

C. Mn_2O_3, brown

D. Mn_3O_4 , black

Answer: A

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

A. Carbon reduction, self-reduction

B. Self-reduction, carbon reduction

C. Electrolytic reduction, cyanide process

D. Cyanide process, electrolytic reduction

Answer: B

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31. The substance not likely to contain $CaCO_3$ is:

A. Sea shells

B. Dolomite

C. Marble statue

D. Calcined gypsum

Answer: D

Watch Video Solution

32. Extraction of Ag from commercial lead is possible by

A. Parke's process

B. Clarke's process

C. Pattinson's process

D. Electrolytic process

Answer: A

Watch Video Solution

33. The chemical composition of slag formed during the smelting process in the extraction of copper is

A. $Cu_2O + FeS$

B. $FeSiO_3$

C. $CuFeS_2$

D. $Cu_2S + FeO$

Answer: B

Watch Video Solution

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

A. Ag

B. Mg

C. Cu

D. Cr

Answer: B

Watch Video Solution

35. Ferric oxide blast furnace is reduced by

A. C

B. CO

C. H_2

D. CO_2

Answer: B

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36. Electric furnaces are lined with magnesia because

A. It melts at a very high temperature

B. It is not affected by acids

C. It has no effect of electricity

D. It liberated oxygen on heating

Answer: A

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37. Furances are lined with calcium oxide as

A. It gives light on heating

B. It is refractory and basic

C. It is not affected by acids

D. It gives O_2 on heating

Answer: B

Watch Video Solution

38. The economical and high melting point compound used in furance lining is

A. PbO

B. CaO

C. HgO

D. ZnO

Answer: B

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39. In the reverberatory furance

A. The flames are in contact with the charge

B. The flames do not come in contact with the charge

C. Only hot gases come in contact with the charge

D. The flames are not at all there

Answer: C

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40. When limestone is heated strongly, it gives off CO_2. In matallurgy this process is known as

A. Calcination

B. Roasting

C. Smelting

D. Ore-dressing

Answer: A

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41. Pig iron is converted into strrl by decreasing the amount of carbon present in it in a

A. Bessemer converter

B. Pyrite burner

C. Blast furnace

D. None of these

Answer: A

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42. Rutile is an ore of

A. Ti

B. Mn

C. Ca

D. Mg

Answer: A

Watch Video Solution

43. The form of iron obtained from blast furnace is:

A. Steel

B. Cast iron

C. Wrought iron

D. Pig iron

Answer: C

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Watch Video Solution

44. Which does not contain aluminium ?

A. Bauxite

B. Corundum

C. Diaspore

D. Dolomite

Answer: D

Watch Video Solution

45. Which is not a silver ore ?

A. Argentite

B. Siderite

C. Horn silver

D. Ruby silver

Answer: B

Watch Video Solution

46. Sandstone in some iron ores is removed by

A. Carbon filters

B. Compressesd air

C. Limestone

D. Sulphuric acid

Answer: C

Watch Video Solution

47. Coating of zinc on iron objects is commonly known as _____.

A. Galvanisation

B. Surface coating

C. Electroplating

D. Hydroplating

Answer: A

Watch Video Solution

48. Blood of human beings contain

A. Fe

B. Mg

C. Co

D. Al

Answer: A

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49. Which of the following is not an ore of Iron

A. Magnetite

B. Haematite

C. Limonite

D. Cuprite

Answer: A

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50. Lepidolite is an ore of

A. K

B. Na

C. Li

D. All of these

Answer: D

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51. Granulated zinc is obtained by

A. Suddently cooling molten zinc

B. Adding molten zinc to water

C. Heating zinc to $150^{\circ} C$

D. Dropping molten zinc drop by drop

Answer: B

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52. Which of the following is not an ore of lead?

A. Galena

B. Cassiterite

C. Anglesite

D. Cerussite

Answer: B

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53. Tin is extracted from tin stone by heating it in a furance with

A. $CaCO_3$

B. Coal

C. CaO

D. Steam

Answer: B

Watch Video Solution

54. Spelter is

A. Impure zinc

B. Impure iron

C. Pure zinc

D. Impure aluminium

Answer: A

Watch Video Solution

55. CO on passing over heated nickel gives

A. $Ni(CO)_4$

B. $NiCO_3$

C. $CO + H_2$

D. $CO_2 + H_2$

Answer: A

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56. The smelting of iron in a blast furance involves all the steps except

A. Reduction

B. Fusion

C. Sublimation

D. Decomposition

Answer: C

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57. Before introducing FeO in blast furance, it is converted to Fe_2O_3 by roasting so that

A. It may not be removed as slag with silica

B. Oresence of it may increase the melting point of charge

C. It may not evaporate in the furnace

D. None of the above

Answer: A

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58. During Bessemerisation of copper, the reaction taking place in the Bessemer converter is

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

B. $Cu_2O + FeS \rightarrow Cu_2S + FeO$

C. $FeO + SiO_2 \rightarrow FeSiO_3$

D. None of the above

Answer: A

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59. Which metal is a liquid at room temperature ?

A. Hg

B. K

C. Na

D. Ti

Answer: A

Watch Video Solution

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

A. Liquation : tin

B. Zone refining : silicon

C. Electrolytic refining : bliser copper

D. Mond' process : aluminium

Answer: D

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61. Which of the following combination represents the correct matching of metals with the most commonly employed ores for their extraction ?

A.

Fe	Zn	Cu	Al
Haematite	Sphalerite	Copper pyrites	Bauxite

B.

Fe	Zn	Cu	Al
Iron pyrites	Zincite	Cuprite	Clay

C.

Fe	Zn	Cu	Al
Siderite	Calamine	Malachite	Clay phosphate

D.

Fe	Zn	Cu	Al
Chalcocite	Magnetite	Copper glance	Bauxite

Answer: A

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

A. Froth flotation

B. Liquation

C. Leaching

D. Magnetic separation

Answer: C

Watch Video Solution

63. 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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64. $\Delta G^{\ominus}$ vs T plot in Ellingham 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

Watch Video Solution

65. 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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66. The ore having two different metal atoms is

A. Haematite

B. Galena

C. Magnetite

D. Copper pyrites

Answer: D

Watch Video Solution

67. Which of the following statements about the 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 $\Delta_f G^{\Theta}$ is negative for roasting of sulphide ore to oxide

D. The $\Delta_f G^{\Theta}$ of the sulphide is greater than those for CS_2 and H_2S

Answer: B

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68. Among the metals Cr, Fe, Mn, Ti, Ba, and Mg, the one that cannot be obtained by reduction of metal oxide by aluminium is

A. Cr

B. Fe

C. Mn

D. Mg

Answer: D

Watch Video Solution

69. Extraction of iron from zine blende is achieved by

A. Electrolytic reduction

B. Roasting followed by reduction with carbon

C. Roasting followed by self-reduction

D. Roasting followed by reduction with other metal

Answer: B

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Watch Video Solution

70. 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 than CS_2

B. Metal sulphides are thermodynamically more stable than CS_2

C. Metal sulphides are less stable than the corresponding oxides

D. CO_2 is thermodynamically more stable than CS_2.

Answer: B

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71. The incorrect statement among the following is

A. Hydrogen is used to reduce NiO

B. Zirconium is refined by Van Arkel method

C. The sulphide ore galena is concentrated by froth flotation

D. In the metallurgy of iron, flux used is SiO_2

Answer: D

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72. Auto-reduction process is used for the extraction of :

A. Hg

B. Cu

C. Pb

D. Fe

Answer: D

Watch Video Solution

73. Bauxide ore is made up of $Al_2O_3 + SiO_2 + TiO_2 + Fe_2O_3$. This ore is treated with conc. $NaOH$ solution at $500K$ 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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74. 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: B

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75. Native silver metel froms a water solube, complesx with a dilute aqueous wsolution of $NaCN$ in the presence of

A. Nitrogen

B. Oxygen

C. Carbon dioxide

D. Argon

Answer: B

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76. 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 a basic flux

Answer: A

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77. The incorrect statement is

A. Calamine and siderite are carbonates

B. Argentite and cuprite are oxides

C. Zinc blende and iron pyrites are sulphides

D. Malachite and azurite are ores of copper

Answer: B

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78. Composition of malachite mineral is

A. $CuCO_3.CuO$

B. $Cu(HCO_3)_2.Cu(OH)_2$

C. $2CuCO_3.Cu(OH)_2$

D. $CuCO_3.Cu(OH)_2$

Answer: D

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79. Select the correct statement :

A. Calcination and roasting take place in reverberatory furnace, and small roasting takes place in small blast furnace

B. Calcination and roasting take place only in small blast furnace

C. Calcination and roasting take place only in reverberatory furnace

D. All are correct

Answer: A

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80. Elingham diagram represents.

A. Change of ΔG with temperature

B. Change of ΔH with temperature

C. Change of ΔG with pressure

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

Answer: A

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81. To carry out a reduction process, select a temperature so as to make

A. ΔG negative

B. ΔG positive

C. ΔH negative

D. ΔH positive

Answer: A

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82. Gold is extracted by hydrometallurgical procees based on its property

A. Of being electropositive

B. To form complexes, which are water soluble

C. Of being less reaction

D. To form salts, which are water soluble

Answer: B

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83. van Arkel method of purification of metals involves converting the metal to:

A. Volatile enough stable compound

B. Volatile unstable compound

C. Non-volatile stable compound

D. None of these

Answer: A

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84. $\Delta G^{\circ} vs T$ plot in the Ellingham diagram slopes down 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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85. Self-reduction of Cu_2S to Cu can be carried out in.

A. Bessemer converter

B. Blast furnace

C. Both (a) and (b)

D. None of these

Answer: A

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86. $Ag_2S + NaCN \rightarrow (a)$

(a) $+ Zn \rightarrow (d)$

(b) is a metal. Hence (a) and (b) are

A. $Na_2\left[Zn(CN)_4\right], Zn$

B. $Na\left[Ag(CN)_2\right], Ag$

C. $Na_2\left[Ag(CN)_4, Ag\right.$

D. $Na_3\left[Ag(CN)_4\right], Ag$

Answer: B

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87. During smelting, an additional is added which combines with impurites to form a fusible mass. The additional substance is called

A. Flux

B. Slag

C. Gangue

D. Ore

Answer: A

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88. 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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89. Complex formed in the following methods are

(I) Mond's process for purification of nickel

(II) Removal of lead poisoning from the body

(III) Cyanide process for extraction of silver

(IV) Froth flotation process for separation of ZnS from galena ore by using depresent.

A.

I	II	III	IV
$Ni(CO)_4$	$[Pb(EDTA)]^{2-}$	$[Ag(CN)_2]^{\ominus}$	$[Zn(CN)_2]$

B.

I	II	III	IV
$Ni(CO)_4$	$[Pb(EDTA)]^{2-}$	$[Ag(CN)_4]^{\ominus}$	$[Zn(CN)_4]^{2-}$

C.

I	II	III	IV
$Ni(CO)_6$	$[Pb(EDTA)]^{4-}$	$[Ag(CN)_2]^{\ominus}$	$[Zn(CN)_6]^{4-}$

D.

I	II	III	IV
$Ni(CO)_4$	$[Pb(EDTA)]^{2-}$	$[Ag(CN)_4]^{3-}$	$[Zn(CN)_4]^{2-}$

.

Answer: B

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90. Casseterite ore consists of magnetic impurity named as

A. Chromite

B. Wolframite

C. Magnetite

D. Limonite

Answer: B

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91. Find the formula of A

$ZnS + O_2 \rightarrow (A) + SO_2.$

A. $ZnCO_3$

B. ZnS

C. $ZnSO_4$

D. $ZnCO_3.3Zn(OH)_2$

Answer: B

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92. 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 process , Cu : Electrolysis , Zr : Van Arkel process , Ga : Zone refining

C. Ni : Mond's process , Cu : Van Arkel process , Zr : Zone refining , Ga : Electrolysis

D. Ni: Electrolysis , Cu : Zone refining , Zr : Van Arkel process , Ga : Mond's process

Answer: B

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93. Which of the following statement is correct regarding Cu extraction ?

A. In the smelting step, carbon reduction takes places

B. During roasting, Cu_2S remains almost unaffected

C. In Besse,er converter, only self-reduction occurs, not slag formation.

D. Blister formed in the blister Cu is due to dissolved CO_2

Answer: B

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94. Which of the following process is not involved in the extraction of Fe ?

A. Gravity separation

B. Leaching

C. Roasting

D. Carbon reduction

Answer: B

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95. Carbon reduction process is not commercially applicable for which of the following set to oxides to extract the respective metal ?

(I) ZnO

(II) Fe_2O_3

(III) Al_2O_3

(IV) SnO_2

(V) MgO.

A. ZnO, Fe_2O_3, SnO_2

B. ZnO, SnO, MgO

C. MgO, Al_2O_3

D. MgO, SnO, Al_2O_3

Answer: C

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96. Which of the following metal can be reduced by carbon reduction as well as self-reduction ?

A. Fe

B. Al

C. Pb

D. None of these

Answer: C

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97. 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 than CS_2

B. Metal sulphides are thermodynamically more stable than CS_2

C. CO_2 is thermodynamically more stable than CS_2

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

Answer: A

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98. The method not used in metallurgy to refine impure metal is :

A. Mond's process

B. Van Arkel process

C. Liquation

D. All are used

Answer: D

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99. Chalcogens are

A. Hydrocarbons

B. Ore-forming elements

C. Oxide-forming elements

D. Those having ability to catenate

Answer: B

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100. The oxidation states of Cu and Fe in chalcopyrite are, respectively,

A. $+2,\ +2$

B. $+1,\ +2$

C. $+1,\ +3$

D. $+2,\ +1$

Answer: D

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101. Thermite reduction is not used for commercial extraction of the respectively metal from which of the following oxides ?

A. Mn_3O_4

B. TiO_2

C. Fe_2O_3

D. Cr_2O_3

Answer: C

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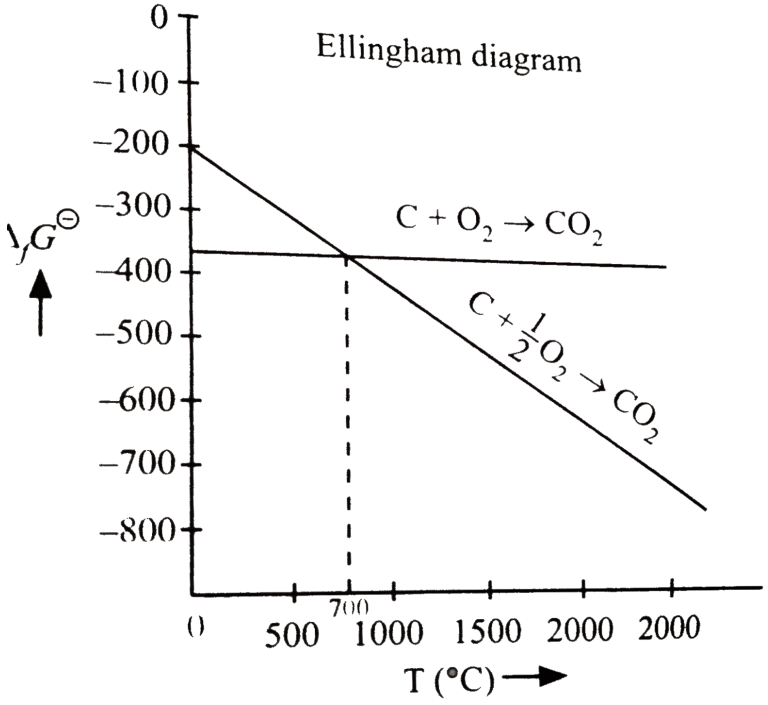

102.

Which of the following is incorrect on the basic of the above Ellingham diagram for carbon ?

A. Up to $710^{\circ}C$, the reaction of formation of CO_2 is energetically more favourable, but above $710^{\circ}C$ the formation of CO is preferred.

B. In principle, carbon can be used to reduce any metal oxide at a sufficiently high temperature.

C. $\Delta S\left[C_{(s)} + 1/2O_{2_{(g)}} \rightarrow CO_{(g)}\right]$

$< \Delta S\left[C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}\right]$

D. Carbon reduces many oxides at elevated temperature because $\Delta_f G^{\ominus} vs$ temperature line has a negative slope.

Answer: C

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103. Copper can be extracted by hydrometallurgy but not zinc because

A. Copper is comparatively less active metal as its reduction potential is high. It can be displaced from solutions of Cu^{2+}

ion by more active metals

B. Zn displaced from solution of Zn^{2+} ion, a more reactive metal than it, but then readily reacts with water forming their corresponding ions and evolve hydrogen gas

C. Both (a) and (b) are correct

D. Copper can never be extracted by hydrometallurgy

Answer: B

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104. Which of the following statement is correct ?

A. Roasting is unnecessarily done for Fe extraction because there is no sulphide ore

B. In the smelting step of Cu extraction, reduction of the ore takes place

C. Ore may not be mineral

D. Sphalerite is the ore of zinc

Answer: D

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105. Consider the following metallurgical processes :

(1) Heating impure metal with CO and distilling the resulting volatile carbonyl $(BP43^{\circ}C)$ and finally decomposing at $150^{\circ}C$ to $230^{\circ}C$ to get pure metal.

(2) Heating the sulphide ore in air until a part is converted to oxide and then further heating in the absence of air to let the oxide react with unchanged sulphide.

(3) Electrolysing the molten electrolyte containing $CaCl_2$ to obtain

the metal

The processes used for obtaining sodium, nickel, and copper are, respectively

A. 1,2 and 3

B. 2,3 and 1

C. 3,1 and 2

D. 2,1 and 3

Answer: C

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106. Consider the following statements . Roasting is carried out to :

(i) convert sulphide to oxide and sulphate.

(ii) to remove impurities of CuS and FeS present in the ore of tin

stone (SnO_2) as $CuSO_4$ and $FeSO_4$.

(iii) melt the ore.

(iv) remove arsenic and sulphur impurities.

of these statements.

A. 1,2 and 3 are correct

B. 1 and 4 are correct

C. 1,2 and 4 are correct

D. 2,3 and 4 are correct.

Answer: C

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Exercise (Assertion-Reasoning)

1. Assertion: All minerals are ore.

Reason: Ores are minerals from which metal can be extracted conveniently and economically.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

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2. Argentite ore is concentrated by froth flotation process.

Argentite is a sulphide ore.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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3. All metals cannot be obtained by carbon reduction.

Carbon is a very strong reducing agent.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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4. Assertion: Durig calcination the ore is heated well below its melting point in the limited supply of air or absence of air.

Reason: The process of calcination is carried out for sulphide ores.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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5. Oxygen is the most abundant element.

Aluminium is the most abundant metal.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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6. A: Highly electropositive metals are extracted by electrolysis of their fused salts.

R: Highly electropositive metals cannot be reduced by chemical reduction methods.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

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7. Zone refining is used to obtain metals in high degree of purity. During electrorefining pure metal is liberated at the cathode.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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8. Assertion :Ti can be purified by Van Arkel process.

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

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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9. Assertion: Aluminothermy is used for extraction of chromium form chromium oxide.

Reason: Alumina has a high melting point.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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10. 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 (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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11. By froth flotation process, carbonate and hydroxide ores are concentrated.

In froth flotation process, pine oil is used as it preferentially wets the gangue particles.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

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12. Standard free energy of formation for Al_2O_3 and Cr_2O_3 at $1273K$ are $-827kJmol^{-1}(ofO_2)$ and $-540kJmol^{-1}(ofO_2)$, respectively.

Al can reduce Cr_2O_3 to Cr since, $\Delta_r G^{\Theta}$ is negative.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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

Impurities are more soluble in melt in pure metal.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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

Reason: Impurities present in nickel form volatile compounds.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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15. 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. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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16. Graphite is used as anode but diamond is not.

There exist free electrons between two parallel sheets of graphite, hence it helps in electrode conduction.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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17. Silver may be prepared by using silver coins. In this process, coins are treated with HNO_3 and then treated with HCl to get $AgCl$, but directly coins are not treated with HCl.

HCl is not a good oxidising agent.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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18. Reduction of Fe_2O_3 with CO is done below $710^\circ C$.

$\Delta_f G^\ominus$ is negative at this temperature , this process is spontaneous.

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

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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Exercise (Integer)

1. Bauxite ore is concentrated by

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2. Carnallite consists of how many different compounds ?

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3. In Goldschmidt's aluminothermoc process, thermite mixture contains _____ parts of Fe_2O_3 and one part of aluminium.

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4. What is the value of x in $CaSO_4.\ xH_2O$, gypsum ?

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5. How many cyanide ions are involved in the following chemical equation ?

$$Au + CN^{\ominus} + H_2O + O_2 \rightarrow \left[Au(CN)_2\right]^{\ominus} + \overset{\ominus}{O}H.$$

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6. 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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7. Amongest the following elements, how many occurs in the earth's crust in the native state ?

$Au, Pt, Hg, Zn, Fe.$

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8. Amongest the following , how many ores can be concentrated by froth flotation process :

Galena, sphalerit, cassiterite, calamine, chalcocite, haematite, argentite.

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9. Amongest the following, how many ores are roasted to convert them into their corresponding metal oxides, alumina, zinc blende, iron pyrites, copper pyrites, galena.

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10. How many of the following are oxide ores

Calamine,cuprite,zinxite, chalcocite,haematite, bauxite,magnetite,cassiterite.

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11. How many ores are sulphide ores from the given ores ?

Azurite, chalcoite,iron pyrites,limonite.

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12. How many metals are commercially purified by Van Arkel method from the given metal ?

$Ti, B, Zr, Pb, Hg.$

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13. How many metals are commercially purified by electrolysis method from the given metals ?

$Na, Al, Pb, Ni.$

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14. Find the number of following reactions which are involved in roasting process :

(i) $S_8 + 8O_2 \xrightarrow{\Delta} 8SO_2 \uparrow$

(ii) $P_4 + 5O_2 \xrightarrow{\Delta} P_4O_{10} \uparrow$

(iii) $4As + 3O_2 \xrightarrow{\Delta} 2As_2O_3 \uparrow$

(iv) $2ZnS + 3O \xrightarrow{\Delta} 2ZnO + 2SO_2 \uparrow$

(v) $ZnCO_3 \xrightarrow{\Delta} 4ZnO + CO_2 \uparrow$.

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15. Find the number of reaction from the given reaction which can show calcination process :

(i) $CaCO_3.MgCO_3 \xrightarrow{\Delta} CaO + MgO + CO_2$

(ii) $CuCO_3.Cu(OH)_2 \xrightarrow{\Delta} 2CuO + H_2O + CO_2$

(iii) $Al_2O_3.2H_2O \xrightarrow{\Delta} Al_2O_3 + 2H_2O$

(iv) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2.$

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16. How many metallic ores are concentrated by magnetic separation method from the given ores ?

Cassiterite, pyrolusite, rutile,magnetite, galena, cinnabar.

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17. Find the number of metal oxides which are decomposed on normal heating from the gives oxides :

Na_2O, Al_2O_3, PbO, Ag_2O, HgO.

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18. Find the number of basic flux from the given compounds :

SiO_2, MgO, CaO, FeO, B_2O_3, $CaCO_3$.

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Watch Video Solution

19. Find the number of metals from the given metals which can be commercially purified by zone refining methods :

$Si, Ge, Ga, Al, Ti, Zr.$

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20. How many metals are commercially extracted by pyrometallurgy from the given metal ?

$Cu, Fe, Sn, Au, K, Na.$

Watch Video Solution

21. Find the number of acidic flux from the given compounds :

$CaCO_3, Na_2B_4O_7, MgSiO_3, FeSiO_3, P_2O_5.$

Watch Video Solution

Watch Video Solution

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

(i) $SiO_2 + CaO \rightarrow CaSiO_3$

(ii) $FeO + SiO_2 \rightarrow FeSiO_3$

(iii) $CaO + P_2O_5 \rightarrow Ca_3(PO_4)_2$

(iv) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

(v) $MgCO_3 + SiO_2 \rightarrow MgSiO_3 + CO_2$.

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23. How many metals are commercially extracted by electrometallury form the given metals ?

$Al, Mg, Na, K, Ag, Hg, Ti, Th, Zr, B.$

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24. How many metals are commercially extracted by hydrometallurgy from the given metals :

$Ag, Mn, In, Cr, Pb, Au.$

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25. How many metals are commercially reduced by Goldschmidt's aluminothermic process from the given metals ?

$Na, Pb, Al, Mn, Sn.$

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26. Find the number of metals which are commercially reduced by self-reduction from the given metals :

$Fe, Al, Z, Sn, Pb, Hg, Cu.$

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27. Find the number of metals which are commercially by carbon reduction method from the given metals :

$Ag, Cr, Mn, Sn, Zn, Fe.$

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Exercise (Fill In The Blanks)

1. Iron is the ____most abundant element in the earth's crust.

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2. Zinc blende is the ore of _____.

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3. Froth flotation process is generally employed for _____ ores.

Watch Video Solution

4. The most abundant metal in earth's crust is _____.

Watch Video Solution

5. Extraction of aluminium form alumina is done by _____.

Watch Video Solution

6. The metal like Si, Ga etc., which are used in semiconductors, are purified by _____.

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7. The purification of crude metals is referred to _____.

Watch Video Solution

8. Magnesite is an ore of _____.

Watch Video Solution

9. The metal present in chlorophyll is _____

Watch Video Solution

10. The process of reduction of oxides by aluminium is known as _____.

Watch Video Solution

11. The process of removal of gangue form ore is known as _____.

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12. Aluminium is obtained from Al_2O_3 by ____reduction.

Watch Video Solution

13. In the metallurgical process for the electro-refining of the metal, the anode is made of .....metal.

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14. Roasting is generally carried out in ____mineral.

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15. Gold is usually found near____mineral.

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16. Metal extracted from sea water is ____.

Watch Video Solution

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

Watch Video Solution

18. The earthly and siliceous impurities which generallty occur with ores are called ____or ____

Watch Video Solution

Watch Video Solution

19. Highly reactive elements occurs in nature in____state.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

24. Sodium cyanide solution is used to extract _____or _____from its ores.

Watch Video Solution

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

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

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27. Flux combines the infusible impurities to form____.

Watch Video Solution

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

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

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

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Exercise (True/False)

1. Smelting is the process of heating the ore with magnesium.

Watch Video Solution

2. Alkali metals are generally extracted by electrolysis of their ores.

Watch Video Solution

3. Levigation is generally employed for concentration of sulphide ores.

Watch Video Solution

4. Every mineral is an ore, but every ore is not a mineral.

Watch Video Solution

5. Slag is a product formed during smelting by combination of flux and impurities.

Watch Video Solution

Watch Video Solution

6. Alkali metals can be obtained by chemical reduction of their compounds.

Watch Video Solution

7. Sylvine is an ore of potassium.

Watch Video Solution

8. Oxide ore are purified by levigation process.

Watch Video Solution

9. During electrorefining of a metal, impure metal is made anode.

Watch Video Solution

10. Highly pure metal can be obtained by zone refining

Watch Video Solution

11. Aluminium is the most abundant metal in the earth's crust.

Watch Video Solution

12. Reactive metals occur in native state.

Watch Video Solution

13. The process of calcination and roasting is carried out in reverberatory furnace.

Watch Video Solution

14. In calcination, ore is heated strongly in the absence of air

Watch Video Solution

15. Copper is found both in free as well as in combined state in nature.

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16. Below $1623K$, Al can reduce MgO to Mg, but above $1623K$, reverse is true.

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17. Mond's process is used for purification of titanium.

Watch Video Solution

18. KCN forms soluble complex with silver galance.

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19. Zinc blende on roasting often gives Zn metal.

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20. Silver is extracted by hydrometallurgy.

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21. The lining of blast furnace is made up of fire clay bricks.

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22. Gypsum is an ore of magnesium.

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Archives (Linked Comprehension)

1. 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 FeO

C. CuS and Fe_2O_3

D. Cu_2O and Fe_2O_3

Answer: A

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2. 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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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.

In self-reduction, the reducing species is.

A. S

B. O^{2-}

C. S^{2-}

D. SO_2

Answer: C

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Archives (Multiple Correct)

1. In the electrolysis of alumina, cryolite is added to

A. Lower the melting point of alumina

B. Increase the electrical conductivity

C. Minimise the anode effect

D. Remove the impurities from alumina

Answer: A::B

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2. Out of the following matals that cannot be obtained by electrolysis of the aquenous solution of their salts is

A. Ag

B. Mg

C. Cu

D. Al

Answer: B::D

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3. Extraction of metal from the ore cassiterite involves

A. Carbon reduction of an oxide ore

B. Self-reduction of sulphide ore

C. Removal of copper impurity

D. Removal of iron impurity

Answer: A::D

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4. 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 Al_2O_3

D. Magnesium from $MgCO_3.CaCO_3$

Answer: C::D

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5. Upon hetaing with Cu_2S the regants that give copper metel are

(i) $CuFeS_2$ (ii) CuO

(iii) Cu_2O(iv) $CuSO_4$

A. $CuFeS_2$

B. CuO

C. Cu_2O

D. $CuSO_4$

Answer: C

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Archives (Single Correct)

1. In the aluminothermite process, aluminium is

A. An oxidising agent

B. A flux

C. A reducing agent

D. A solder

Answer: C

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2. The major role of flourspar, CaF_2 which is added in small amount in the electrolytic reduction of Al_2O_3 dissolved on fused cryolite in fused cryolite is

A. As a catalyst

B. To make the used mixture very conducting

C. To increase the temperature of the melt

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

Answer: B

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3. In the commercial electrochemical process for aluminium extraction, the electrolyte used is

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

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

C. A molten mixture of Al_2O_3 and Na_3AlF_6

D. A molten mixture of $AlO(OH)$ and $Al(OH)_3$

Answer: C

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4. The chemical process in the production of steel from haematite ore involves

A. Reduction

B. Oxidation

C. Reduction followed by oxidation

D. Oxidation followed by reduction

Answer: D

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5. Electrolytic reduction of alumina to aluminum by the Hall-Heroult process is carried out

A. In the presence of $NaCl$

B. In the presence of fluorite

C. In the presence of cryolite, which forms a melt with lower melting temperature

D. In the presence of cryolite, which forms a melt with higher melting temperature

Answer: C

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6. The chemical composition of slag formed during the smelting process in the extraction of copper is

A. $Cu_2O + FeS$

B. $FeSiO_3$

C. $CuFeS_2$

D. $Cu_2S + FeO$

Answer: B

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7. Which of the following process is used in the extractive metallurgy of magnesium ?

A. Fused salt electrolysis

B. Self-reduction

C. Aqueous solution electrolyisis

D. Thermite reduction

Answer: A

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

B. $X = \left[Au(CN)_2\right]^{3-}, Y = \left[Zn(CN)_4\right]^{2-}$

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

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

Answer: A

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9. 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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10. Which ore contains both iron and copper?

A. Cuprite

B. Chalcocite

C. Chalcopyrite

D. Malachite

Answer: C

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11. Extraction of iron from zine 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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12. Native silver metel froms a water solube, complesx with a dilute aqueous wsolution of $NaCN$ in the presence of

A. Nitrogen

B. Oxygen

C. Carbon dioxide

D. Argon

Answer: B

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13. 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, III in magnetite

D. III in haematite and II, III in magnetite

Answer: D

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14. Sulfide 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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15. Which series of reactions correctly represents chemical rections related to iron and its compounds ?

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

B. $Fe \xrightarrow{O_2 . heat} Fe_3O_4 \xrightarrow{CO, 600^\circ C} FeCl_2 \xrightarrow{CO, 700^\circ C} Fe$

C. $Fe \xrightarrow{dil . H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4, O_2} Fe(SO_4)_3 \xrightarrow{heat} Fe$

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

Answer: B

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Archives (Fill In The Blanks)

1. In the basic Bessemer process for the manufacture of steel, the lining of the converter is made up of ___. The slag formed consists of ___.

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2. In the thermite process, ____is used as a reducting agent.

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3. Cassiterite is an ore of

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4. In extractive metallurgy of zinc, partial fusion of ZnO with coke is called ___ and reduction of the ore to moleten metal is called _____(smelting, calcining, roasting, sintering).

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Archives (Subjective)

1. Write the chemical equations involved in the extraction of lead from galena by self-reduction process.

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2. State the conditions under which the preparation of alumina from aluminium is carried out. Give the necessary equations which need not be balanced.

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3. Each of the following statements is true only under some specific conditions. Write the condition for each sub-equation in not more than two sentences.

(i) Metals can be recovered from their ores by chemical methods.

(ii) High purity metals can be obtained by zone refining method.

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4. Write the balanced equations for the reaction occuring when gold is dissolved in aqua regia.

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5. Answer the following questions briefly.

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

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

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

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

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

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6. Give balanced equations for the following.

"Extraction of silver from silver glance by cyanide process".

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7. Write balanced equations for "the extraction of copper from pyrites by self-reduction".

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8. Give briefly the isolation of magnesium from sea water. Give equations for the steps involved.

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9. Give reasons for the following. "Although aluminium is above hydrogen in the electrochemical series, it is stable in air and water".

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10. When the ore haematite is burnt in air with coke around $2000K$ along with lime, the process not only produces steel but also produces a silicate slag that is useful in making building materials such as cement. Discuss the same and show through balanced chemical equation.

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11. Write the chemical reactions involved in the extraction of metallic silver from argentite.

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12. How is boron obtained from borax ? Give the chemical reactions involved. Draw the structure of B_2H_6 and give its reaction with HCl.

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13. Write down the reactions involved in the extraction of Pb. What is the oxidation number of lead in litharge ?

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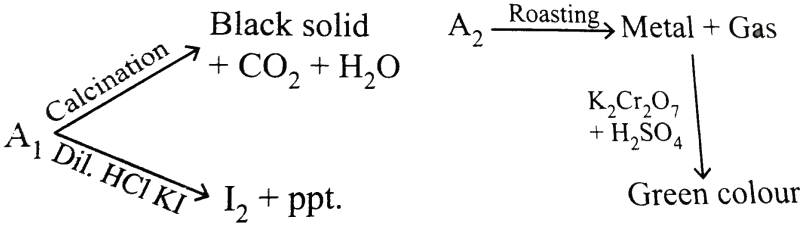
14. A_1 and A_2 are two ores of metal M. A_1 on calcination gives a black precipitate, CO_2 and water. Identify A_1 and A_2.



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