



# **CHEMISTRY**

# **BOOKS - CENGAGE CHEMISTRY (ENGLISH)**

# 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 ?



**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?



- 4. Calamine is an ore of
- (a) Hg
- (b) Zn
- ( c) Ca
- (d) Cd

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5. Interpret 2 points from the following Ellingham diagram.



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**6.** Suggest a condition under which magnesium could reduce alumina.

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

before reduction ?



**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?



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

Al, Zn, Fe and Pb.



# Solved Example

1. Sulphdies ores are converted to oxides before reduction . This is

explained on the basic of which of the following ?



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

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

 $egin{aligned} &\Delta_{f}G^{\Theta}\left(MgO_{\left(s
ight)}
ight) = &-941kJ/molat1273K\ &\Delta_{f}G^{\Theta}\left(MeO_{\left(s
ight)}
ight) = &-314kJ/molat2273K\ &\Delta_{f}G^{\Theta}\left(CO_{\left(g
ight)}
ight) = &-439kJ/molata11273K\ &\Delta_{f}G^{\Theta}\left(CO_{\left(g
ight)}
ight) = &-628kJ/molat2273K \end{aligned}$ 

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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feasible, yet it does no occur at room temperature.



**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



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 in thermite process :

(a)3  $Mn_3O_4+8Al
ightarrow9Mn+4Al_2O_3$ 

(b)  $Cr_2O_3+2Al
ightarrow Al_2O_3+Cr$ 

(c)  $2Fe+Al_2O_3
ightarrow 2Al+Fe_2O_3$ 

(d)  $B_2O_3+2Al
ightarrow 2B+Al_2O_3$ 

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

B.  $Cr_2O_3 + 2Al 
ightarrow Al_2O_3 + 2Cr$ 

C.  $2Fe + Al_2O_3 
ightarrow 2Al + Fe_2O_3$ 

D.  $B_2O_3+2Al
ightarrow 2B+Al_2O_3$ 

#### Answer: C



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





Answer the questions given below :

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

A. HgS

B.  $Bi_2S_3$ 

 $\mathsf{C}. PbS$ 

D.  $CS_2$ 

#### Answer: A



**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

 ${\rm B.}\,H_2S$ 

 $\mathsf{C}.\,Bi_2S_3$ 

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

 $\mathsf{B}.\, PbS$ 

 $\mathsf{C}.\,Bi_2S_3$ 

D. All of these

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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. Free enegry , G = H - TS, is state function that indicates whther a reaction is spontaneous or non-spontaneous. If you think of TS as the part of the system's enegry that is disordered already, then (H - TS) is the part of the system's energy that is still ordered and therefore free to cause spontaneous change by becoming disordered.

Also,  $\Delta G = \Delta H - T\Delta S$  From the second law of thermodynamics, a reaction is spontaneous if  $\Delta_{total}S$  is positive, non-spontaneous if  $\Delta_{total}S$  is negative, and at equilibrium if  $\Delta_{' \rightarrow tal}S$  is zero. Since,  $-T\Delta S = \Delta G$  and since  $\Delta G$  and  $\Delta S$  have opposite sings, we can restate the thermodynamic criterion for the spontaneity of a reaction carried out a constant temperature and pressure. IF  $\Delta G < 0$ , the reaction is spontaneous.

If  $\Delta G > 0$ , the reaction is non-spontaneous.

If  $\Delta G = 0$ , the reaction is at equilibrium.

Read the above paragraph carefully and answer the following questions based on the above comprehension.

If an endothermic reaction is non-spontaneous at freezing point of water and becomes feasible at its boiling point, then

A. -ve

B. + ve

C. Zero

D. Nothing can be said

## Answer: C



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

#### Answer: D



**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 
ightarrow Mg + CO

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

C. MgO + Zn 
ightarrow Mg + ZnO

D. ZnO + Mg 
ightarrow 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



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

 $C + H_2 O \xrightarrow{ ext{Heat heat}} CO + H_2$ 

CO is separated from  $H_2$  and then used to separate Ni from COby forming a volatile compound, nickel tetracarbonyl  $(Ni(CO)_4)$ .  $Ni + 4CO \rightarrow Ni(CO)_4$ 

(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 ?



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

(A) is :

A.  $CaCO_3$ 

B.  $MgCO_3$ 

C.  $CaCO_3$ .  $MgCO_3$ 

D.  $CaSO_4$ .  $MgCO_3$ 

Answer: C



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

(B) is.

A.  $CO_2$ 

B.  $SO_2$ 

 $\mathsf{C}.\,CO$ 

D.  $SO_3$ 

Answer: A



**23.** 
$$A \xrightarrow{ ext{Calcination}} CaO + MgO + (B)$$

Name of the product (A) is :

A. Dolomite

B. Limenstone

C. Magnesite

D. Malachite

Answer: A



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

Lime water is.

A. CaO

B.  $CA(OH)_2$ 

 $C. CaCO_3$ 

D.  $CaCO_3$ .  $Ca(OH)_2$ 

Answer: B



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

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 ?



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



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.



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



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 two examples.

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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. Alkali metals cannot be extracted by reduction of their oxides

and other compounds because



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

(i) Zone refining

(ii) 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).



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



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?



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



**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 ?



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

(a) Sn from  $SnO_2$ 

(b) Zn from ZnO

( c) Cr from  $Cr_2O_3$ .
**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.



25. Which method would you suggest for the separation of the

metals in the following mixtures ?

(a) Zinc and iron

(b) Copper and magnesium.



# 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



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

A. Fe

B. K

C. Al

D. None of these

Answer: A



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

A.  $CaCO_3$ 

 $\mathsf{B.}\, CaO$ 

 $\mathsf{C.}\,SiO_2$ 

D. None of these

## Answer: C



B. Roasting of the ore

C. Additing carbon to the ore

D. Extracting the metal from the ore

## Answer: D



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 Watch Video Solution 7. (vii) Which element is found in human body? A. Fe B. Mg C. Ca D. Al Answer: A::C Watch Video Solution

**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

**11.** (xi) Which 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.** Which process of purification is represented by the following reaction ?

 $T _{ ext{Impure}} i + 2I_2 \stackrel{250 ^\circ C}{\longrightarrow} TiI_4 \stackrel{1400 ^\circ C}{\longrightarrow} T _{ ext{Pure}} i + 2I_2$ 

A. Zone refining

B. Mond's process

C. Van Arkel method

D. Poling

## Answer: C



**14.** Impure 
$$Ni + 4CO \xrightarrow{60-80^{\circ}C} Ni(CO)_4 \xrightarrow{180^{\circ}C} Ni + 4CO$$

The above process of purification of the metal is known as

A. Mond's process

B. Van Arkel method

C. Zone refining

**D.** Cupellation

#### Answer: A



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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|--|
|  |
| <b>2.</b> (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.



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



**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.



11. (b) Platinum, indium etc. are known as noble metals because

they are \_\_\_\_towards many common reagents.

Watch Video Solution **12.** (c) iron is the purest form of iron. Watch Video Solution **13.** (d) Passivity of iron is due to the formation of thin film of on its surface. Watch Video Solution

14. ( e) Phenimenon of removing layers of basic oxides from metals

before electroplating is called \_\_\_\_\_.





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|---|
|   |
| <b>19.</b> In electrorefining the impure metal is made  |
| <b>Vatch Video Solution</b>   |
|   |
|   |
| Exercises (Linked Comprehension)  |
|   |
|   |
| <b>1.</b> Copper is the most noble of first row transition metals and   |
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| <b>1.</b> 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 $[Cu_2Cl(OH)_3]$ , |

 $ig[Cu_2(OH)_2CO_3ig]$ . 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



**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  $[Cu_2Cl(OH)_3]$ , cuprite  $(Cu_2O)$ , copper glance  $(Cu_2S)$ , and malachite

 $[Cu_2(OH)_2CO_3]$ . 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

 $\mathsf{B.}\,FeS$ 

 $\mathsf{C.}\,Fe_2O_3$ 

D.  $FeSiO_3$ 

#### Answer: D



**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  $[Cu_2Cl(OH)_3]$ , cuprite  $(Cu_2O)$ , copper glance  $(Cu_2S)$ , and malachite  $[Cu_2(OH)_2CO_3]$ . 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.  $O^{2-}$ 

 $\mathsf{C}.\,S^{2\,-}$ 

D.  $SO_2$ 

Answer: C

The chemical formula of copper pyrites is.

A.  $CuFeS_2$ 

B.  $Cu_2O$ 

 $\mathsf{C.}\, Cu_2S$ 

D.  $CuCO_3$ .  $Cu(OH)_2$ 

#### Answer: A



The chemical composition of the slag formed during smelting is.

A.  $CuSiO_3$ 

B.  $FeSiO_3$ 

 $\mathsf{C.}\,CaSiO_3$ 

D.  $Cu_2O$ .  $SiO_2$ 

**Answer: B** 

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



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

8. Extraction of aluminium can be understood by :



Electrolytric reduction of  $Al_2O_3$ :

 $\mathsf{Electrolysis}: Al_2O_3 + Cryolite + CaF_2$ 

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

# 9. Extraction of aluminium can be understood by :



Electrolytric reduction of  $Al_2O_3$ :

 $\mathsf{Electrolysis}: Al_2O_3 + Cryolite + CaF_2$ 

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



Electrolytric reduction of  $Al_2O_3$ :

 $\mathsf{Electrolysis}: Al_2O_3 + Cryolite + CaF_2$ 

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



# **11.** Extraction of aluminium can be understood by :



Electrolytric reduction of  $Al_2O_3$ :

 $\mathsf{Electrolysis}: Al_2O_3 + Cryolite + CaF_2$ 

Cathode : Carbon inside the Fe container

Anode : Graphite rods.

The molten 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** 

**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





**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.

 $2PbS + 3O_2 
ightarrow A + 2SO_2$ 

The name of A is.

A. Litharge

B. Galena

C. Sesquioxide

D. None of these

Answer: A

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.  $Cu_2O$ 

 $\mathsf{B.}\, CuO$ 

 $\mathsf{C}. Cu_2O$ 

 $\mathsf{D.}\, CuS$ 

Answer: C

**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



**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

 $\mathsf{D.}\,Fe$ 

#### Answer: B



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



**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.  $PbSO_4 + H_2SO_4$ 

 $\mathsf{B.} \ PbCl_2 + HCl$ 

C.  $PbSiF6 + H_2SiF_6$ 

D. None of these

# Answer: C

# Watch Video Solution

**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



A is.

A.  $CuFeS_2$ 

B.  $MgCl_2$ .  $6H_2O$ 

C.  $Al_2O_3$ .  $2H_2O$ 

 $\mathsf{D.}\, CuS$ 

Answer: C



Answer: A





### Answer: A





D. None of these

Answer: B









A is.

A.  $As_2S$ 

 $\mathsf{B.}\, CuS$ 

 $\mathsf{C.}\,Na_2S$ 

D. HgS

Answer: A



Composition of B is.

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

B. 
$$Na_2[Ag(CN)_2]$$

 $\mathsf{C}.\,Na\big[Ag(CN)_4\big]$ 

D. 
$$Na_3 ig[ Ag(CN)_2 ig]$$

#### Answer: A





B is.

A. Ferromagnetic

**B.** Paramagnetic

C. Linear complex

D. Coordinate number of central atom is 4

**30.** 
$$A_{(\text{Sulphide ore})} + NaCN \stackrel{\text{Air}}{\iff} B_{(\text{Complex})} + Na_2S \stackrel{O_2}{\longrightarrow} C.$$

C is.

A.  $Na_2SO_4$ 

B.  $Na_2SO_3$ 

 $\mathsf{C}.Na_2O$ 

D.  $Na_2O_2$ 

# Answer: A









C. Mond's process

D. Van Arkel process

# Answer: B





Answer: B





A. CuS

B.  $FeS_2$ 

 $\mathsf{C.}\, CuFeS_2$ 

D.  $Fe_3O_4$ 

Answer: C



# 35.

Identify (B) and (C):

A. FeS + FeO

- B.  $FeO + Cu_2S$
- $C. FeS + Cu_2O$
- D.  $Cu_2O + Cu_2S$

#### Answer: B



# 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)

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



A. pure Cu

B. Blister Cu

C. Pig iron

 $\mathsf{D.}\,FeO$ 

## 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

Answer: B

# Watch Video Solution

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

ZnO, thus formed is treated with dilute  $H_2SO_4$ .

 $ZnO + H_2SO_4 
ightarrow ZnSO_4 + H_2O$  ....(ii)

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

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

ZnO on dissolution in NaOH gives

A.  $Na_2ZnO_2$ 

B.  $NaZnO_2$ 

C.  $NaZn(OH)_4$ 

D.  $NaZn_2O_3$ 

Answer: A



**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. 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.  $2ZnSO_4 + H_2O \rightarrow 2Zn + 2H_2SO_4 + O_2....(iii)$ ZnO on dissolution in NaOH gives B. 2.32

C. 4.64

D. 9.28

Answer: C

Watch Video Solution

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

ZnO, thus formed is treated with dilute  $H_2SO_4$ .

 $ZnO + H_2SO_4 
ightarrow ZnSO_4 + H_2O$  ....(ii)

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

 $2ZnSO_4 + H_2O 
ightarrow 2Zn + 2H_2SO_4 + O_2$ ....(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

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



- **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

6. The metal which can't form amalgam is

A. Fe

B. Zn

C. Ni

D. Au

# Answer: A::C



7. Metallury involves steps :

A. Cencentration of ore

B. Reduction of ore

C. Purification

D. Alloy formation

#### Answer: A::B::C



9. Which of the following are correct processes ?

A. 
$$Fe + Al_2O_3 
ightarrow 2Al + Fe_2O_3$$
  
B.  $ZnO + C 
ightarrow Zn + CO$   
C.  $Cr_2O_3 + 2Al 
ightarrow 2Cr + Al_2O_3$   
D.  $2[Ag(CN)_2]^{\Theta} + Zn 
ightarrow 2Ag + [Zn(CN)_4]^{2-1}$ 

### Answer: B::C::D



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



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

A. Cu

B. Hg

C. Pb

D. Al

Answer: A::B::C

12. Which of the following reaction occur during calcination ?

A. 
$$CaCO_3 
ightarrow CaO + CO_2$$
  
B.  $2Al(OH)_3 
ightarrow Al_2O_3 + 3H_2O$   
C.  $4FeS_2 + 11O_2 
ightarrow 2Fe_2O_3 + 8SO_2$   
D.  $Cu_2S + 2CuO 
ightarrow 4Cu + SO_2$ 

Answer: A::B



13. Leaching can be used for extraction of

A. Pb

 $\mathsf{B.}\,Al$ 

 $\mathsf{C}.\,Ag$ 

D. Au

Answer: A::B::D



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

A. Acetate

B. Nitrate

C. Chloride

D. Sulphate

Answer: A::B



16. The extraction of metals from oxide ores involve :

A. Reduction with carbon

B. Reduction with aluminium

C. Electrolytic reduction

D. Reduction with CO

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



**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.  $Al_2O_3$ B. CuO

 $\mathsf{C}.\,MgO$ 

D. ZnO

Answer: B::D



**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.** In the electrolytic reduction of pure  $Al_2O_3$ . Fluorspar  $(CaF_2)$  is

added to

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



**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

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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

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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

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**23.** Which of the following metals cannot be obtained by electrolysis /

A. Ag

B. Mg

C. Au

D. Na

Answer: A::C

**O** Watch Video Solution

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

A. Poling

**B.** Cupellation

Answer: A::C::D

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**25.** Select the correct statements for Ellingham diagram.

A. The slope of the curves of the formation of metal oxide is +ve because  $\Delta_f G^{\Theta}$  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  $(s \rightarrow 1 \text{ or } 1 \rightarrow g)$ 

C. Each curve is not a straight line except when some changes

takes place in phase  $(s \rightarrow 1 \text{ or } 1 \rightarrow g)$ .

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



Answer: B::C::D

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

A.  $Cu_2O$ 

 $\mathsf{B.}\,PbO$ 

C. HgO

D. CaO

Answer: A::B::C

**O** 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

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**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



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

$$\begin{array}{l} \mathsf{A}.\,Cu_2S+2Cu_2O\rightarrow 6Cu+SO_2\\\\ \mathsf{B}.\,CuFeS_2+2H_2SO_4\rightarrow CuSO_4+FeSO_4+2H_2S\\\\ \mathsf{C}.\,Ag_2S+2NaCN\rightarrow \left[Ag(CN)_2\right]^{\Theta}+Na_2S\\\\ \mathsf{D}.\,CuCO_3+H_2SO_4\rightarrow CuSO_4+H_2O+CO_2.\end{array}$$

Answer: B::C::D

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33. The reduction of an oxide by aluminium is called as Roasting.

True/False

A. Ellingham process

B. Goldschmidt's aluminothermite process

C. Kroll's process

D. Van Arkel process

Answer: A::C::D

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**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



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



- 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

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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



**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

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- 41. Select the correct statements :
  - A. In hydrometallurgy, Zn is used as oxidising agent in the purification of Ag from  $\left[Ag(CN)_2\right]^{\Theta}$ .
  - 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

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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



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

A. Flux

B. Slag

C. Minerals

D. Gangue

Answer: D



**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



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



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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



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

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

A. 
$$ZnCO_3 
ightarrow ZnO + CO_2$$

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

 $\text{C.}~2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$ 

D.  $Al_2O_3.2H_2O 
ightarrow Al_2O_3 + 2H_2O$ 

#### Answer: C

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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

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

A. Chloride

B. Sulphate

C. Sulphide

D. Nitrate

Answer: D

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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

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13. In the aluminothermite process, aluminium is

A. Oxidising agent

B. Flux

C. Reducing agent

D. Solder

### Answer: C



14. Magnetic separation is used for increasing concentration of the

following

A. Horon silver

B. Calcite

C. Haematite

D. Magnesite

Answer: C

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

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



16. When the sample of copper with zinc impurityn is to be purified

by electrolysis, the appropriate electrode are .

A. Cathode : Pure Zn

 $\mathsf{Anode}:\mathsf{Pure}Cu$ 

B. Cthode : Impure sample

Anode : Pure Cu

C. Cathode : Impure Zn

Anode : Impure sample

D. Cathode : Pure Cu

Anode : Impure sample

# Answer: D



**17.** During the process of electrolytic refining of copper some metals present as impurity settle as 'anode mud'. These are

A. Sn and Ag

B. Pb and Zn

C. Ag and Au

D. Fe and Ni

Answer: C

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**18.** Heating mixture of  $Cu_2O$  and  $Cu_2S$  will give

A.  $Cu + SO_2$ 

- B.  $Cu + SO_3$
- $\mathsf{C.}\, CuO+CuS$
- 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

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20. Heating of ore in presence of air to remove sulphur impurities

is called

A. Calcination

**B.** Roasting

C. Smelting

D. None of these

Answer: B

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

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 factors 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



24. The least stable oxide at room temperature is

A. ZnO

B. CuO

 $\mathsf{C.}\,Sb_2O_3$ 

D.  $Ag_2O$ 

Answer: D

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25. High purity copper metal is obtained by

A. Carbon reduction

B. Hydrogen reduction

- C. Electrolytic reduction
- D. Thermite process

# Answer: C

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26. Corumdum is

A.  $SrO_2$ 

 $\operatorname{B.}Al_2O_3$ 

 $C. CaCl_2$ 

D.  $Cu_2Cl_2$ 

Answer: B

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

A. Malachite

B. Cassiterite

C. Galena

D. Manetite

Answer: C

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**28.** Which of the following metal is extracted by the use of cyanide

solution?

A. Mg

B. Ag

C. Cu

D. Na

Answer: B

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**29.** When  $MnO_2$  is fused with KOH and  $O_2$ , what is the product

formed and its colour?

 $MnO_2 + KOH + O_2 \rightarrow \_\_\_+ H_2O$ 

A.  $K_2 MnO_4$ , purple green

B.  $KMnO_4$  , purple

C.  $Mn_2O_3$ , brown

D.  $Mn_3O_4$  , black

Answer: A



**30.** Pb and Sn are extracted from their chief ore respectively 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 : (2003)

A. Sea shells

B. Dolomite

C. Marble statue

D. Calcined gypsum

Answer: D

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**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



**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** 

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**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

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35. Ferric oxide blast furnace is reduced by

A. C

B. CO

 $\mathsf{C}.\,H_2$ 

 $\mathsf{D.}\, CO_2$ 

# 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



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



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

A. PbO

B. CaO

C. HgO

D. ZnO

# Answer: B

**D** Watch Video Solution

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



**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 steel 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



43. Which form of iron is extracted from blast furnance :

A. Steel

B. Cast iron

C. Wrought iron

D. Pig iron

Answer: C

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44. Which does not contain aluminium?

A. Bauxite

B. Corundum

C. Diaspore

D. Dolomite

Answer: D

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45. Which is not a silver ore ?

A. Argentite

B. Siderite

C. Horn silver

D. Ruby silver

Answer: B

46. Sandstone in some iron ores is removed by

A. Carbon filters

B. Compressesd air

C. Limestone

D. Sulphuric acid

Answer: C

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**47.** Coating of zinc on iron objects is commonly known as \_\_\_\_\_.

A. Galvanisation

B. Surface coating

C. Electroplating

D. Hydroplating

Answer: A



C. Co

D. Al

Answer: A

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



Answer: B

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



54. Spelter is

A. Impure zinc

B. Impure iron

C. Pure zinc

D. Impure aluminium

Answer: A

55. CO on passing over heated nickel gives

- A.  $Ni(CO)_4$
- B.  $NiCO_3$
- $C.CO + H_2$
- $\mathsf{D.}\,CO_2+H_2$

## Answer: A



**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

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

the Bessemer converter is

A. 
$$Cu_2S+2Cu_2O
ightarrow 6Cu+SO_2$$

 $\text{B.} \ Cu_2O + FeS \rightarrow Cu_2S + FeO$ 

C.  $FeO + SiO_2 
ightarrow FeSiO_3$ 

D. None of the above

### Answer: A

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59. This metal is a liquid at room temperature :

B. K

C. Na

D. Ti

Answer: A

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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

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

|    | Fe                                | Zn             | Cu                           | Al        |
|----|-----------------------------------|----------------|------------------------------|-----------|
| A. | Haematite                         | Sphaleri       | te Copper                    | Bauxite   |
|    |                                   |                | $\operatorname{pyrites}$     |           |
| В. | Fe                                | Zn             | Cu                           | Al        |
|    | Iron pyrites Zincite Cuprite Clay |                |                              |           |
|    | $Fe \qquad Z$                     | $\overline{n}$ | Cu                           | Al        |
| C. | Siderite C                        | alamine        | Malachite                    | Clay      |
|    |                                   |                |                              | phosphate |
| D. | Fe                                | Zn             | Cu                           | Al        |
|    | Chalcocite                        | Magneti        | te Copper $_{\text{glance}}$ | Bauxite   |

### Answer: A



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

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**63.** Heating mixture of  $Cu_2O$  and  $Cu_2S$  will give

A.  $Cu + SO_2$ 

B.  $Cu + SO_3$ 

 $\mathsf{C.}\,CuO+CuS$ 

D.  $Cu_2SO_3$ 

Answer: A

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**64.**  $\Delta G^{\,\Theta}$  vs T plot in Ellingham diagram slopes downward for the reaction .

A. 
$$Mg+rac{1}{2}O_2 o MgO$$
  
B.  $2Ag+rac{1}{2}O_2 o Ag_2O$   
C.  $C+rac{1}{2}O_2 o CO$   
D.  $CO+rac{1}{2}O_2 o CO_2$ 

Answer: C

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

A.  $CaCO_3 
ightarrow CaO + CO_2$ 

 $\mathrm{B.}\,2C+O_2\rightarrow 2CO$ 

 $\mathsf{C}.\,C+O_2 o CO_2$ 

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

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**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

 $\mathsf{B.}\,Fe$ 

 $\mathsf{C}.\,Mn$ 

 $\mathsf{D}.\,Mg$ 

Answer: D



69. By which process and is extracted from zinc blende?

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



**70.** Which of the following factors 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  $SiO_2$



**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.  $2Fe_2O_3+3C
ightarrow 4Fe+3CO_2$
$\mathsf{B.}\, CO_2 + C \to 2CO$ 

C.  $CaCO_3 
ightarrow CaO + CO_2$ 

D.  $FeO + SiO_2 
ightarrow FeSiO_3$ 

#### Answer: B



**75.** Native silver metel froms a water solube, complex with a dilute aqueous solution of NaCN in the presence of

A. Nitrogen

B. Oxygen

C. Carbon dioxide

D. Argon

Answer: B

**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

 $\mathsf{B.}\, Cu(HCO_3)_2.\, Cu(OH)_2$ 

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

D. 
$$CuCO_3$$
.  $Cu(OH)_2$ 

Answer: D



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

**D** Watch Video Solution

80. Ellingham diagram represents change of

A. Change of  $\Delta G$  with temperature

B. Change of  $\Delta H$  with temperature

C. Change of  $\Delta G$  with pressure

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

Answer: A



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

make

A.  $\Delta G$  negative

B.  $\Delta G$  positive

C.  $\Delta H$  negative

D.  $\Delta H$  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

**84.**  $\Delta G^{\circ} vsT$  plot in the Ellingham diagram slopes down for the reaction.

A. 
$$Mg+rac{1}{2}O_2 o MgO$$
  
B.  $2Ag+rac{1}{2}O_2 o Ag_2O$   
C.  $C+rac{1}{2}O_2 o CO$   
D.  $CO+rac{1}{2}O_2 o CO_2$ 

# Answer: C



**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.** 
$$Ag_2S + NaCN 
ightarrow (a)$$

(a) +Zn 
ightarrow (d)

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

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

- $\mathsf{B}.\,Na\big[Ag(CN)_2\big],\,Ag$
- C.  $Na_2[Ag(CN)_4, Ag]$
- $\mathsf{D}.\, Na_3\big[Ag(CN)_4\big],\, Ag$



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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. Complexes formed in the following methods are :

(1) Mond's process for purification of nickel

(2) Removal of lead poisoning from the body

(3) Cyanide process for extraction of silver

(4) Froth floatation process for separation of ZnS from galena ore

by using depressant

A.  $\begin{array}{ccc} I & II & III & IV \\ Ni(CO)_4 & \left[Pb(EDTA)\right]^{2-} & \left[Ag(CN)_2\right]^{\Theta} & \left[Zn(CN)_2\right] \end{array}$ Β.  $\begin{matrix} I & II & III & IV \\ Ni(CO)_4 & \left[Pb(EDTA)\right]^{2-} & \left[Ag(CN)_4\right]^{\Theta} & \left[Zn(CN)_4\right]^{2-} \end{matrix}$ C.  $\begin{matrix} I & II & III & IV \\ Ni(CO)_6 & \left[Pb(EDTA)\right]^{4-} & \left[Ag(CN)_2\right]^{\Theta} & \left[Zn(CN)_6\right]^{4-} \end{matrix}$ D.  $\begin{array}{ccc} I & II & III & IV \\ Ni(CO)_4 & \left[Pb(EDTA)\right]^{2-} & \left[Ag(CN)_4\right]^{3-} & \left[Zn(CN)_4\right]^{2-} \end{array}$ 

# 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

 $ZnS + O_2 
ightarrow (A) + SO_2.$ 

A.  $ZnCO_3$ 

B. ZnO

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, van 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



**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



**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



**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



97. Which of the following factors 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.** The elements of group 16 are called as chalcogens. Give reason.

A. Hydrocarbons

- B. Ore-forming elements
- C. Oxide-forming elements
- D. Those having ability to catenate

Answer: B

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

A. +2, +2B. +1, +2C. +1, +3D. +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.  $Mn_3O_4$ 

 $\mathsf{B}.\,TiO_2$ 

 $\mathsf{C.}\,Fe_2O_3$ 

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.

$$egin{aligned} \mathsf{C}.\,\Delta S \Big[ C_{\,(\,s\,)} \,+\,1/2O_{2_{\,(g)}} \,&
ightarrow\,CO_{\,(\,g\,)} \,\Big] \ &<\Delta S ig[ C_{\,(\,s\,)} \,+\,O_{2\,(\,g\,)} \,&
ightarrow\,CO_{2\,(\,g\,)} \,\Big] \end{aligned}$$

D. Carbon reduces many oxides at elevated temperature

because  $\Delta_f G^{\Theta} vs$  temperature line has a negative slope.

### Answer: C



**103.** Copper can be extracted by hydrometallurgy but not zinc. Explain.

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



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



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 :

- 1. Convert sulphide into oxide
- 2. Melt the ore

3. Remove moisture, water of hydration and expel organic matter

4. Remove sulphur and arsenic in the form of volatile oxides

Out 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



3. All metals cannot be obtained by carbon reduction.

Carbon is poor reducing agent.

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

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



**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



5. A:Oxygen is the most abundant element on the surface of earth.

R: Aluminium is the most abundant metal in Earths crust.

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

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

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

- 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



**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



**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

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

**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



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

Reason: Impurities present in nickel form volatile compounds.

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



**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.

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



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.

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



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.

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  $710^{\circ}C$ .

 $\Delta_f G^{\Theta}$  is negative at this temperature , this process is spontaneous.

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

# 2. Carnallite consists of how many different compounds ?

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|   |
| <b>3.</b> In Goldschmidt's aluminothermite process, thermite mixture contains parts of $Fe_2O_3$ and one part of aluminium. |
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|   |
| <b>4.</b> 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 ?

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



phase refining ?

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



**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.



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

Azurite, chalcoite, iron pyrites, limonite.



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

Na, Al, Pb, Ni.



**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)  $2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2 \uparrow$   
(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) 
$$CaCO_3$$
.  $MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$   
(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)  $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$ .





**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 :

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

**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 mant metals are commercially extracted by pyrometallurgy

from the given metal ?

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

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

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

22. How mant 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.



**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.

**27.** Find the number of metals which are commercially reduced 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 \_\_\_\_\_.

| <b>3.</b> Froth flotation process is generally employed for ores.                         |
|---|
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|   |
| <b>4.</b> Most abundant metal in earth crust is :   |
| Vatch Video Solution  |
|   |
| <b>5.</b> Extraction of aluminium form alumina is done by                                 |
| Watch Video Solution  |
|   |
| <b>6.</b> The metal like $Si, Ga$ etc., which are used in semiconductors, are purified by |

| <b>7.</b> The purification of crude metals is referred to              |
|--|
| Watch Video Solution   |
|  |
| <b>8.</b> Magnesite is an ore of                                       |
| Watch Video Solution   |
|  |
| <b>9.</b> The metal present in chlorophyll is                          |
| <b>Vatch Video Solution</b>  |
|  |
|  |
| <b>10.</b> Aluminium oxide is not reduced by chemical reactions due to |
|  |



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|  |
| <b>12.</b> Aluminium is obtained from $Al_2O_3$ byreduction.                   |
| Match Video Colution   |
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|  |
|  |
| <b>13.</b> In the metallurgical process for the electro-refining of the metal, |
| the anode is made ofmetal.   |
|  |
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|  |
|  |
| 14 Departing is generally serviced out in minoral                              |
| <b>14.</b> Roasting is generally carried out inmineral.                        |
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**19.** Highly reactive elements occurs in nature in\_\_\_\_\_state.

| Watch Video Solution  |
|---|
|   |
| 20. Minerals from which metals are extracted conveniently and           |
| economically are called   |
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|   |
| <b>21.</b> The complete of extracting the metal form its ores is called |
| <b>Watch Video Solution</b>   |
|   |

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

\_\_\_of air.



**26.**\_\_\_\_\_involves treating the powdered ore with a suitable reagent which selectively dissolves the ore but not the impurities.

| <b>Watch Video Solution</b>   |
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|   |
| <b>27.</b> Flux combines the infusible impurities to form                 |
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|   |
|   |
| <b>28.</b> acts as an acidic flux whileacts as a basic flux.              |
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|   |
|   |
| <b>29.</b> In the metallurgy of copper, the flux used to remove the basic |
| impurity of $FeO$ is .  |



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.

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

3. Levigation is generally employed for concentration of sulphide

ores.

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|--|--|
|  |  |
|  |  |
| <b>4.</b> Every mineral is an ore, but every ore is not a mineral. |  |

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

and impurities.



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





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

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|---|--|
| <b>12.</b> Reactive metals occur in native state. |  |

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



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

**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.

**18.** *KCN* forms soluble complex with silver glance.

| <b>Watch Video Solution</b>                                |
|--|
| <b>19.</b> Zinc blende on roasting often gives $Zn$ metal. |
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| <b>20.</b> Silver is extracted by hydrometallurgy.         |
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**21.** The lining of blast furnace is made up of fire clay bricks.



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  $[Cu_2Cl(OH)_3]$ , cuprite  $(Cu_2O)$ , copper glance  $(Cu_2S)$ , and malachite  $[Cu_2(OH)_2CO_3]$ . 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



**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  $[Cu_2Cl(OH)_3]$ , cuprite  $(Cu_2O)$ , copper glance  $(Cu_2S)$ , and malachite  $[Cu_2(OH)_2CO_3]$ . 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

 ${\rm B.}\,FeS$ 

C.  $Fe_2O_3$ 

D.  $FeSiO_3$ 

Answer: D



**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  $[Cu_2Cl(OH)_3]$ , cuprite  $(Cu_2O)$ , copper glance  $(Cu_2S)$ , and malachite  $[Cu_2(OH)_2CO_3]$ . 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



- 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.  $CuFeS_2$ 

 $\mathsf{B.}\, CuO$ 

 $C. Cu_2O$ 

D.  $CuSO_4$ 

# Answer: C

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Archives (Single Correct)

**1.** In the aluminothermite process, aluminium is a reducing agent.

true/False

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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



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.  $FeSiO_3$ 

 $C. CuFeS_2$ 

 $\mathsf{D.}\, Cu_2S+FeO$ 

Answer: B



**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  $+CN^{-} + H_2O \xrightarrow{o_2} [X] + OH^{-}$ 

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

Identify the complexes [X] and [Y]

$$\begin{aligned} \mathbf{A}. \, X &= \left[ Au(CN)_2 \right]^{\Theta}, Y = \left[ Zn(CN)_4 \right]^{2-} \\ \mathbf{B}. \, X &= \left[ Au(CN)_2 \right]^{3-}, Y = \left[ Zn(CN)_4 \right]^{2-} \\ \mathbf{C}. \, X &= \left[ Au(CN)_2 \right]^{\Theta}, Y = \left[ Zn(CN)_6 \right]^{4-} \\ \mathbf{D}. \, X &= \left[ Au(CN)_4 \right]^{\Theta}, Y \left[ Zn(CN)_4 \right]^{2-} \end{aligned}$$

#### Answer: A



**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

**11.** Extraction of Zinc from zinc blende is achieved by Roasting followed by self-reduction. True/False



**12.** Native silver metel froms a water solube, complex with a dilute aqueous wsolution of NaCN in the presence of

A. Nitrogen

B. Oxygen

C. Carbon dioxide

D. Argon

Answer: B

**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 g , C u and P b.

True/False

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

 $\begin{array}{l} \mathsf{A.} \ Fe \xrightarrow{Cl_2, heat} FeCl_3 \xrightarrow{heat, air} FeCl_2 \xrightarrow{Zn} Fe \\ \mathsf{B.} \ Fe \xrightarrow{O_2, heat} Fe_3O_4 \xrightarrow{CO, 600^{\circ}C} FeCl_2 \xrightarrow{CO, 700^{\circ}C} Fe \\ \mathsf{C.} \ Fe \xrightarrow{dil. H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4, O_2} Fe(SO_4)_3 \xrightarrow{heat} Fe \\ \mathsf{D.} \ Fe \xrightarrow{O_2, heat} FeO \xrightarrow{dil. H_2SO_4} FeSO_4 \xrightarrow{heat} Fe \end{array}$ 

#### Answer: B

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Archives (Fill In The Blanks)

1. Bessemer converter is used for manufacture of



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|---|
|   |
| <b>3.</b> Cassiterite is an ore of  |
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|   |
|   |
| <b>4.</b> 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).



Archives (Subjective)

1. Write the chemical equations involved in the extraction of lead

from galena by self-reduction process.



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



# 3. State True/False

Metals can be recovered from their ores by chemical methods.









**10.** When the ore haematite is burnt in air with coke around 2000*K* 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.



**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.



black precipitate,  $CO_2$  and water. Identify  $A_1$  and  $A_2$ .

Black solid  $A_1 \xrightarrow{\text{Calcination}} + CO_2 + H_2O$   $A_1 \xrightarrow{\text{Calcination}} I_2 + ppt.$   $A_2 \xrightarrow{\text{Roasting}} Metal + Gas$   $K_2Cr_2O_7$   $+ H_2SO_4$ Green colour