



CHEMISTRY

BOOKS - MODERN PUBLISHERS CHEMISTRY (HINGLISH)

GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

Example

1. In general which metal do you expect to occur in the native state in nature? Give example.



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

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3. Name two examples each of the following types of ores :

(a) Oxides (b) Sulphides (c) Carbonates (d) Silicates

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4. How does sodium cyanide act as depressant in preventing

ZnS from forming the froth ?

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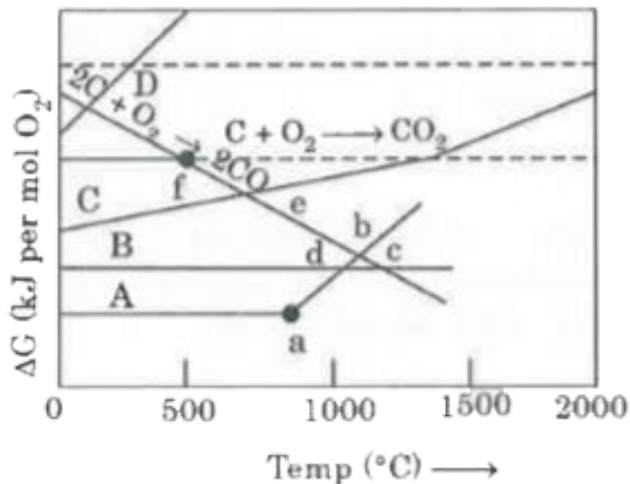
5. What is flux ? How is it useful?

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

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7. A part of Ellingham diagram for some metal oxides (Based upon 1 mole of O_2) and carbon is shown.



In figure A,B,C and D represent curves for metal oxides and a,b,c,d ,e and f are temperatures. Answer the following :

- (i) Will B oxide reduce metal oxide of A or C or both ?
- (ii) Which metal can be reduced thermally ?
- (iii) Will oxide of B be reduced by coke above temperature c or below temperature c ?
- (iv) Will the formation of CO or CO_2 be preferred above temperature f ?
- (v) What does temperature 'a' represent ?



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8. Copper can be extracted by hydrometallurgy but not zinc.

Explain.

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9. Free energies of formation ($\Delta_f G^\ominus$) of $MgO(s)$ and $CO(g)$ at $1273K$ and $2273K$ are given below :

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

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

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

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

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

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

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

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



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13. (a) Give one example each of the following:

(i) Acidic flux (ii) Basic flux

(b) What happens when

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

(ii) Haematite oxidises carbon to carbon monoxide.



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



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Conceptual Questions

1. Which method of refining is generally used when a metal of high degree of purity is needed?

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2. Name the metal used as a reducing agent in aluminothermie process.

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3. What is basic difference between calcination and roasting?

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4. Which is the cheapest and most abundant reducing agent which is used in the extraction of metals ?

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5. Why does CaO react with SiO_2 to form a slag?

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6. Why is the formation of sulphate in calcination sometimes advantageous ?

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7. Why Al cannot be reduced by carbon?

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8. How does NaCN act as a depressant in preventing ZnS from forming the froth ?

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

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

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

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

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13. What is cupellation ?



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14. What type of ores are roasted?



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15. Granulated zinc is obtained by



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16. What is Kroll process ?



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17. The iron obtained from the blast furnace is called:

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18. 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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19. Name three forms of iron. How do these three forms differ?

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20. Reducing agent of haematite in blast – furnace is

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21. (a) What is a slag ?

(b) Give the principle of zone refining ?

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

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

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

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

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24. Giving examples differentiate between roasting and calcination.

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25. What is meant by benefaction process ?

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26. Write the equation of the net reaction taking place in Hall Heroult electrolytic method for the collection of aluminium ?

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27. Why is the froth flotation method selected for the concentration of Sulphide ores ?

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

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29. Why Al cannot be reduced by carbon?

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

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31. Out of C and CO which is a better reducing agent for Feo.

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

(ii) In the upper part of blast furnace (Lower temperature)

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32. Name the method of refining of metals such as germanium.

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33. (i) Name the method of refining of metals such as Germanium.

(ii) In the extraction of Al, impure Al_2O_3 is dissolved in conc. NaOH to form sodium aluminate and leaving impurities

behind. What is the name of this process?

(iii) What is the role of coke in the extraction of iron from its oxides?

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34. Name the method of refining which is based on the principle of adsorption.

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

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

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36. (i) Name the method of refining of metals such as Germanium.

(ii) In the extraction of Al , impure Al_2O_3 is dissolved in conc. $NaOH$ to form sodium aluminate and leaving impurities behind. What is the name of this process?

(iii) What is the role of coke in the extraction of iron from its oxides?



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37. (a) Write the principle of method used for the refining of germanium.

(b) Out of PbS and $PbCO_3$ (ores of lead), which one is concentrated by froth floatation process preferably ?

(c) What is the significance of leaching in the extraction of aluminium ?

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38. What is the role of collectors in Froth Floatation process ?

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39. What is the role of depressant in froth floatation process?

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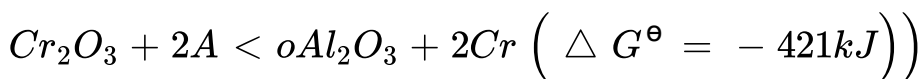
1. What type of ores can be concentrated by magnetic separation method ?

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

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3. The reaction



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



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



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Ncert File Ncert Textbook Exercises

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



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

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

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4. Explain:

(i). Zone refining

(ii). Column chromatography.

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

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

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

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

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

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

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

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12. Describe a method for refining nickel.

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

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14. Giving examples differentiate between roasting and calcination.

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15. How is 'cast iron' different from 'pig iron'?

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16. Differentiate between "minerals" and "ores".

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

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18. (a) Give an example of zone refining of metals.

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

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

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

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

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

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



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



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



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

(a) Electrolytic refining

(b) Zone refining

(c) Vapour phase refining.



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



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Ncert File Ncert Exemplar Problems Multiple Choice Questions Type I

1. In the extraction of chlorine by electrolysis of brine _____.

- A. oxidation of Cl^{-1} ion to chlorine gas occurs.
- B. reduction of Cl^{-} ions to chlorine gas occurs.
- C. for overall reaction ΔG^{\ominus} has negative value.
- D. a displacement reaction takes places.

Answer: C



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

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

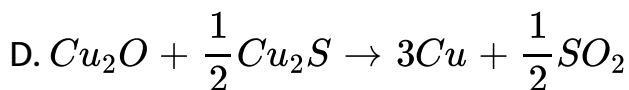
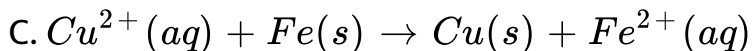
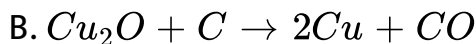
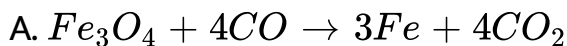
C. sulphides of copper (I) and iron (II)

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

Answer: C

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3. Which one of the following reactions is an example of auto-reduction?



Answer: D



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

- A. *Al* and *Fe*
- B. *Al* and *Cu*
- C. *Fe* and *Cu*
- D. *Cu* and *Ag*

Answer: A



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5. Zone refining is based on the principle that

- A. impurities of low boiling metals can be separated by distillation.
- B. impurities are more soluble in molten metal than in solid metal.
- C. different components of a mixture are differently adsorbed on an adsorbent.
- D. vapours of volatile compound can be decomposed in pure metal.

Answer: B



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

A. FeS

B. CO

C. Cu_2S

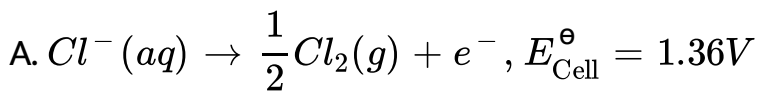
D. SO_2

Answer: C

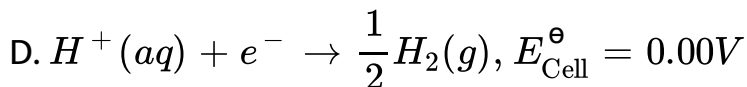
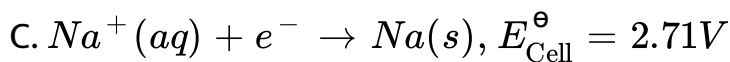
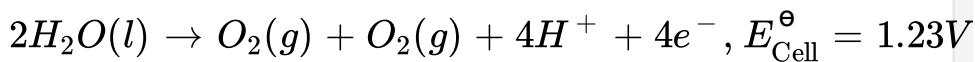


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7. Brine is electrolysed by using inert electrodes. The reaction at anode is _____



B.



Answer: A



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8. In the metallurgy of aluminium,

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

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

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

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

Answer: B



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

A. *Cu* and *Zn*

B. *Ge* and *Si*

C. *Zr* and *Ti*

D. Zn and Hg

Answer: A

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

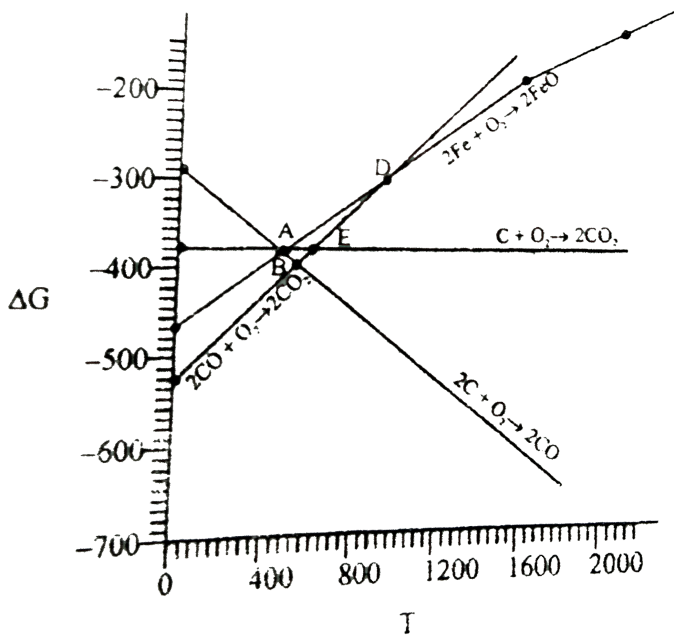
- A. displacement of metal by some other metal from the complex ion.
- B. roasting of metal complex.
- C. calcination followed by roasting.
- D. thermal decomposition of metal complex.

Answer: A



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



A. Below temperature at point A.

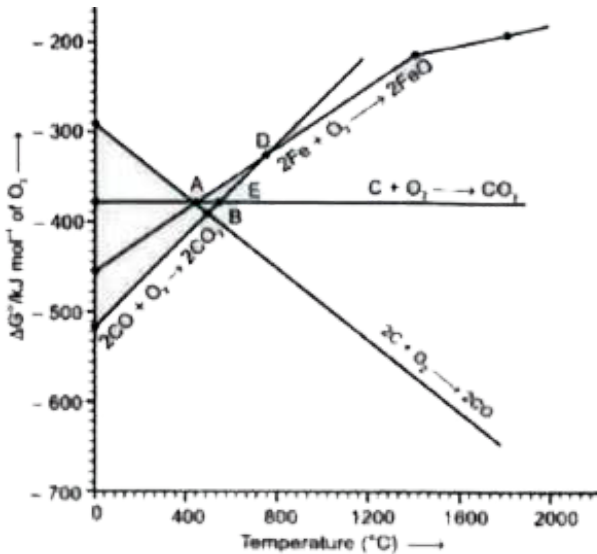
B. Approximately at the temperature corresponding to point A.

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

D. Above temperature at point A.

Answer: D

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12.

Below point 'A' FeO can _____ .

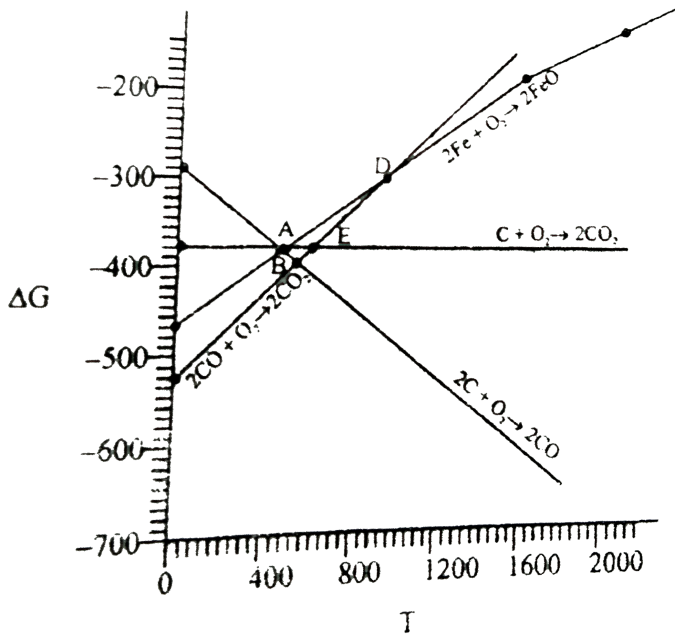
- A. be reduced by carbon monoxide only.
- B. be reduced by both carbon monoxide and carbon.
- C. be reduced by carbon only.
- D. not be reduced by both carbon and carbon monoxide.

Answer: A



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13. For the reduction of FeO at the temperature corresponding to point D, which of the following statements



is correct?

- A. ΔG value for the overall reduction reaction with carbon monoxide is zero.
- B. ΔG value for the overall reduction reaction with a mixture of 1 mol carbon and 1 mol oxygen is positive.
- C. ΔG value for the overall reduction reaction with a mixture of 2 mol carbon and 1 mol oxygen will be positive.

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

Answer: A

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Ncert File Ncert Exemplar Problems Multiple Choice Questions Type ii

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

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

A. Point A

B. Point B

C. Point D

D. Point E

Answer: B::D



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2. Which of the following options are correct ?

A. Cast iron is obtained by remelting pig iron with scrap

iron and coke using hot air blast.

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

complex.

C. Nickel is purified by zone refining.

D. Zr and Ti are purified by van Arkel method.

Answer: A::D

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

A. lower the melting point of Al_2O_3 .

B. increase the conductivity of molten mixture.

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

D. acts as catalyst.

Answer: A::B



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

- A. Collectors enhance the non-wettability of the mineral particles.
- B. Collectors enhance the wettability of gangue particles.
- C. By using depressants in the process two sulphide ores can be separated.
- D. Froth stabilisers decrease wettability of gangue.

Answer: A::C



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

- A. using collectors.
- B. adjusting the proportion of oil to water.
- C. using depressant.
- D. using froth stabilisers.

Answer: B::C

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6. Common impurities present in bauxite are_____

- A. CuO

B. ZnO

C. Fe_2O_3

D. SiO_2

Answer: C::D



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

A. Haematite

B. Galena

C. Copper pyrites

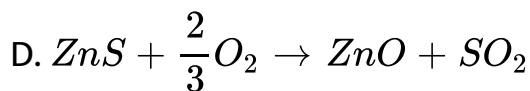
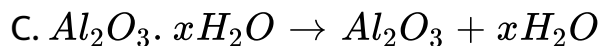
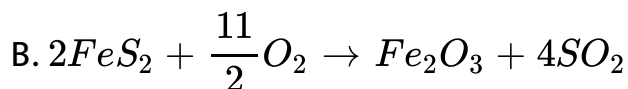
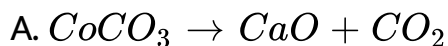
D. Magnetite

Answer: B::C



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8. Which of the following reactions occurs during calcination ?



Answer: A::C



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

A. haematite

B. calamine

C. iron pyrites

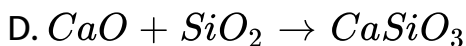
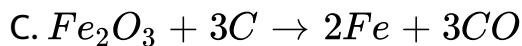
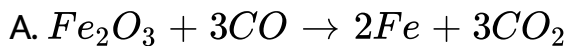
D. sphalerite

Answer: A:B



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



Answer: A:D



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

A. heating with stream of carbon monoxide.

B. heating with iodine.

C. liquation.

D. distillation

Answer: A::B



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12. Which of the following statements are correct?

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

B. Copper matte contains Cu_2S and ZnS .

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

D. Zinc can be extracted by self-reduction.

Answer: A:C

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13. In the extraction of chlorine from brine _____

- A. ΔG^\ominus for the overall reaction is negative
- B. ΔG^\ominus for the overall reaction is positive
- C. E^\ominus for overall reaction has negative value.
- D. E^\ominus for overall reaction has positive value.

Answer: B:C

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

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

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

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

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

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

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

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

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

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

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



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



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



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



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

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

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17. Give two requirements for vapour phase refining.

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



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Ncert File Ncert Exemplar Problems Matching Type Questions

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

Column I	Column II
A. Pendulum	1. Chrome steel
B. Malachite	2. Nickel steel
C. Calamine	3. Na_3AlF_6
D. Cryolite	4. $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$
	5. ZnCO_3

A. $A - 1, B - 2, C - 3, D - 4$

B. $A - 2, B - 4, C - 5, D - 3$

C. $A - 2, B - 3, C - 4, D - 5$

D. $A - 4, B - 5, C - 3, D - 2$

Answer: B

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

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

A. $A - 1, B - 2, C - 4, D - 5$

B. $A - 4, B - 3, C - 1, D - 2$

C. $A - 3, B - 4, C - 2, D - 1$

D. $A - 5, B - 4, C - 3, D - 2$

Answer: B

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

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

A. A-4 , B-2 , C-3, D-1

B. A-2 , B-3 , C-1, D-5

C. A-1 , B-2 , C-3, D-4

D. A-3 , B-4 , C-5, D-1

Answer: A

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

Column I	Column II
A. Sapphire	1. Al_2O_3
B. Sphalerite	2. NaCN
C. Depressant	3. Co
D. Corundum	4. ZnS
	5. Fe_2O_3

A. A-2, B-3, C-2, D-1

B. A-5, B-4, C-3, D-2

C. A-2, B-3, C-4, D-5

D. A-1, B-2, C-3, D-4

Answer: A

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

Column I	Column II
A. Blistered Cu	1. Aluminium
B. Blast furnace	2. $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \longrightarrow 6\text{Cu} + \text{SO}_2$
C. Reverberatory furnace	3. Iron
D. Hall-Heroult process	4. $\text{FeO} + \text{SiO}_2 \longrightarrow \text{FeSiO}_3$
	5. $2\text{Cu}_2\text{S} + 3\text{O}_2 \longrightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2$

A. A-2, B-3, C-4, D-1

B. A-1, B-2, C-3, D-5

C. A-5, B-4, C-3, D-2

D. A-4, B-5, C-3, D-2

Answer: A

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Ncert File Ncert Exemplar Problems Assertion And Reason Type Questions

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

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

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A



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

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

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

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

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A



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

Reason : Cresols stabilise the froth in Froth Floatation method

- A. Both assertion and reason are true and reason is the correct explanation of assertion.
- B. Both assertion and reason are true but reason is not the correct explanation of assertion.
- C. Assertion is true but reason is false.
- D. Assertion is false but reason is true.

Answer: B



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

Reason : Semiconductors are of high purity.

- A. Both assertion and reason are true and reason is the correct explanation of assertion.
- B. Both assertion and reason are true but reason is not the correct explanation of assertion.
- C. Assertion is true but reason is false.
- D. Assertion is false but reason is true.

Answer: B

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

Reason : Copper is extracted by hydrometallurgy.

- A. Both assertion and reason are true and reason is the correct explanation of assertion.
- B. Both assertion and reason are true but reason is not the correct explanation of assertion.
- C. Assertion is true but reason is false.
- D. Assertion is false but reason is true.

Answer: C



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Memory Test Say True Or False

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



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



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



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4. Flux combines with slag to form gangue. True or False



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5. Calcination is the process of heating the ore strongly in the _____ of air.

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6. Silver is extracted by hydrometallurgy.

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7. Zone refining method is used for refining

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8. The ΔG versus T line for Al lies below ΔG vs T line for Cr at all temperatures indicating that Al should reduce Cr(III) at all

temperatures.



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Memory Test Complete The Missing Links

1. The earthy and siliceous impurities which generally occur with ores are called _____ or _____



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



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3. Purest form of iron is

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4. The process involving reduction of metal oxide with coke or carbon monoxide is called.....

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5. (iv) Zirconium is best refined by zone refining method.

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

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

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8. How can copper be extracted from low grade copper ores?

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9. Bauxite, the ore of aluminium is purified by which process ?

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10. Sulphide ores are generally concentrated by

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11. Roasting of copper pyrites is done:

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Memory Test Choose The Correct Alternative

1. Pine oil is added in froth floatation method because it increases the non-wettability/wettability of the mineral particles.

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2. Why is Zn but not copper used for the recovery of Ag from its cyanide complex $[Ag(CN)_2]^-$

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3. The iron obtained from the blast furnace is called:

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

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5. (a) In the electrorefining of impure copper metal, what are used as cathode and anode ?

(b) Show the formation of $MgCl_2$ from magnesium and chlorine atoms.

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

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

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

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8. Haematite is Fe_2O_3/Fe_3O_4

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Revision Exercises Multiple Choice Questions

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

A. Gypsum

B. Dolomite

C. Magnesite

D. Carnallite

Answer: A



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Revision Exercises Multiple Choice Questions

1. A substance which reacts with gangue to form easily fusible material is called

A. Flux

B. slag

C. ore

D. catalyst

Answer: A



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2. Titanium can be obtained in a state of high purity by

A. Van Arkel method

B. Poling

C. Cupellation

D. Electrorefining

Answer: A



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3. The ore having two different metal atoms is

- A. Haematite
- B. Copper pyrites
- C. Malachite
- D. Magnetite

Answer: B



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4. The earthy impurities present in the mineral are called

- A. Flux
- B. gangue

C. matte

D. slag

Answer: B



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5. Cinnabar is an ore of

A. Hg

B. Ag

C. Sn

D. Al

Answer: A



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6. Pyrolusite is

A. *Ag*

B. *Hg*

C. *Sn*

D. *Mn*

Answer: D



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7. Malachite is an ore of

A. *Hg*

B. *Cu*

C. *Sn*

D. *Mn*

Answer: B



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8. Sulphide ores are generally concentrated by

A. Froth floatation

B. Roasting

C. Electrolysis

D. Calcination

Answer: A



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9. The process of zone refining is used for :

- A. concentration of an ore
- B. reduction of metal oxide
- C. purification of metal
- D. purification of an ore

Answer: C



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10. The metal always found in the free state is

- A. Gold
- B. calcium
- C. copper
- D. zinc

Answer: A



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11. Bauxite is an ore of

- A. aluminium
- B. calcium

C. copper

D. zinc

Answer: A



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

A. O

B. Si

C. Al

D. Fe

Answer: A



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13. Which of the following ores is not concentrated by froth floatation process?

- A. Haematite
- B. Magnetite
- C. Copper pyrite
- D. Bauxite

Answer: C



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14. Common impurities present in bauxite are.....

A. CuO

B. ZnO

C. Fe_2O_3

D. None of these

Answer: C



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15. In which of the following minerals, *Al* is present ?

1. Fluorspar

2. Mica

3. Feldspar

4. Cryolite

A. Cryolite

B. Mica

C. Feldspar

D. Fluorspar

Answer: D



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16. In the manufacture of iron from haematite, limestone is added to act as _____.

A. Flux

B. Slag

C. A reducing agent

D. An oxidising agent

Answer: A



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17. Purest form of iron is

A. Cast iron

B. Wrought iron

C. Hot steel

D. Stainless steel

Answer: B



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18. In blast furnace, iron oxide is reduced by

A. Carbon

B. CO

C. Zinc

D. Limestone

Answer: B



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19. The metal which can be obtained from anode mud is

A. Cu

B. Fe

C. Ag

D. Zn

Answer: C

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20. Match the ore (Column I) with the metal (Column II)

Column I	Column II
(i) Bauxite	(A) iron
(ii) Magnetite	(B) copper
(iii) Malachite	(C) aluminium
(iv) Galena	(D) calcium
	(E) lead

A. (i)-(C) , (ii)-(A), (iii)-(B), (iv)-(E)

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

C. (i)-(E) , (ii)-(C), (iii)-(B), (iv)-(E)

D. (i)-(D) , (ii)-(A), (iii)-(B), (iv)-(E)

Answer: A



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21. Match the process given in column I with its description given in column II.

Column I	Column II
(i) Baeyer's process	(A) leaching to concentrate silver ore
(ii) Mac Arthur Forest process	(B) concentration of sulphide ores
(iii) Froth floatation process	(C) leaching of bauxite ore
(iv) Mond's process	(D) refining of nickel

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

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

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

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

Answer: C

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22. Match the method used (Column I) with the metal for which it is used (Column II)

Column I	Column II
(i) Zone refining	(a) Titanium
(ii) Van-Arkel	(b) Nickel
(iii) Vapour phase refining	(c) Germanium
(iii) Liquation	(d) Lead

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

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

C. (i)-(C) , (ii)-(D), (iii)-(B), (iv)-(D)

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

Answer: D

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23. Match the method (column I) with its example (column II)

Column I	Column II
(i) Calcination	(a) $2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$
(ii) Roasting	(b) $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$ (c) $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$

A. (i)-(C) , (ii)-(A)

B. (i)-(C), (ii)-(B)

C. (i)-(A) , (ii)-(B)

D. (i)-(B), (ii)-(A)

Answer: A



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24. Match the alloy of copper (column I) with its composition (column II)

Column I	Column II
(i) German silver	(a) Cu, Sn
(ii) Brass	(b) Cu, Zn, Ni
(iii) Bronze	(c) Cu, Zn
	(d) Cu, Ni

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

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

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

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

Answer: B



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25. Match the process (column I) with its name (column II)

Column I	Column II
(i) Heating the ore strongly with limited supply of air	(a) Roasting
(ii) Heating the ore with excess of air	(b) Smelting
(iii) Reducing calcined ore with carbon	(c) Calcination

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

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

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

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

Answer: C



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Revision Exercises Passage Based Questions

1. Extraction is a process of obtaining metals in the free state from concentrated ores. The two main operations for working of the ore are, conversion of concentrated ore to its oxide from (oxidation or de-electronation) and conversion of oxide to the metal (reduction or de-electronation). The concentrated ore is converted to metal oxide by calcination and roasting. The oxide of the metal is converted to metallic form by using reducing agents such as C, CO or active metals (Na, K, Mg, Al, etc). The Ellingham diagrams help in choosing the better reducing agents. Some metals like gold and silver are extracted by leaching process which involves both oxidation and reduction.

What is the basic difference between calcination and roasting

.



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2. Extraction is a process of obtaining metals in the free state from concentrated ores. The two main operations for working of the ore are, conversion of concentrated ore to its oxide form (oxidation or de-electronation) and conversion of oxide to the metal (reduction or de-electronation). The concentrated ore is converted to metal oxide by calcination and roasting. The oxide of the metal is converted to metallic form by using reducing agents such as C, CO or active metals (Na, K, Mg, Al, etc). The Ellingham diagrams help in choosing the better reducing agents. Some metals like gold and silver are extracted by leaching process which involves both

oxidation and reduction.

What type of ores are roasted ?



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3. Extraction is a process of obtaining metals in the free state from concentrated ores. The two main operations for working of the ore are, conversion of concentrated ore to its oxide from (oxidation or de-electronation) and conversion of oxide to the metal (reduction or de-electronation). The concentrated ore is converted to metal oxide by calcination and roasting. The oxide of the metal is converted to metallic form by using reducing agents such as C,CO or active metals (Na, K, Mg, Al, etc). The Ellingham diagrams help in choosing the better reducing agents. Some metals like gold and silver are extracted by leaching process which involves both

oxidation and reduction.

Why zinc and not copper used for the recovery of metallic silver from its $[Ag(CN)_2]^-$ complex ?



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4. Extraction is a process of obtaining metals in the free state from concentrated ores. The two main operations for working of the ore are, conversion of concentrated ore to its oxide from (oxidation or de-electronation) and conversion of oxide to the metal (reduction or de-electronation). The concentrated ore is converted to metal oxide by calcination and roasting. The oxide of the metal is converted to metallic form by using reducing agents such as C,CO or active metals (Na, K, Mg, Al, etc). The Ellingham diagrams help in choosing the better reducing agents. Some metals like gold and silver

are extracted by leaching process which involves both oxidation and reduction.

Give two examples of metal oxides which can be reduced to metals by C or CO.

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Revision Exercises Assertion Reason Questions

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

Reason: In froth floatation process, pine is used because it preferentially wets the ore particles.

A. Assertion and reason both are correct statements but reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

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

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

Answer: D

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2. Assertion: Gold and platinum occur in native state.

Reason: Gold and platinum are expensive metals.

- A. Assertion and reason both are correct statements but reason is correct explanation for assertion.
- B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- C. Assertion is correct statement but reason is wrong statement.
- D. Assertion is wrong statement but reason is correct statement.

Answer: C



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3. Assertion: Aluminothermy is used for extraction of chromium from chromium oxide.

Reason: Alumina has a high melting point.

A. Assertion and reason both are correct statements but reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

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

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

Answer: B



4. Ti can be purified by Van Arkel process.

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

- A. Assertion and reason both are correct statements but reason is correct explanation for assertion.
- B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- C. Assertion is correct statement but reason is wrong statement.
- D. Assertion is wrong statement but reason is correct statement.

Answer: A



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5. Assertion: In Mond process, nickel is heated in a stream of CO forming a volatile complex.

Reason: This is an electrolytic refining method.

- A. Assertion and reason both are correct statements but reason is correct explanation for assertion.
- B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- C. Assertion is correct statement but reason is wrong statement.

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

Answer: C

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Revision Exercises One Word Short Sentence Answer

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

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2. Slag and Flux

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3. Give the formula of the ores: haematite and bauxite.

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4. Name two important ores of iron.

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5. Write the names and formulae of two ores of aluminium.

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6. Name two metals which exist in the native or free state.

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7. 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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8. Define aluminothermy.

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9. CHROMATOGRAPHY

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10. What type of ores are roasted?

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11. Name the method of metal refining which is generally used when a metal of high degree of purity is needed.

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12. Name the sulphide ores of (i) zinc (ii) lead.

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13. Name two ores which are concentrated by froth floatation method.



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14. Write reduction reaction occurring in the blast furnace in the metallurgy of iron at 900-1500 K.



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15. What are ores ? Name one sulphide ore.



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16. Why Al cannot be reduced by carbon?



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

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18. What is the role of depressant in froth floatation process?

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

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

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21. Give an important ore each of zinc and magnesium.

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

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

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24. Suggest a List of metals that are extracted electrolytically.

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25. Blister copper is:

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26. Define the term flux.

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27. Name the metal used as a reducing agent in Aluminothermic process.

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Revision Exercises Cbse Qs

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

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2. Differentiate between a mineral and an ore.

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3. Why is it that only sulphide ores are concentrated by the froth floatation process ?

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

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5. What is the role of collector and froth stabilizer in froth floatation process ?

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6. Name the method used for refining of copper metal

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7. Name the method used for the refining of Nickel metal.

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

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Revision Exercises Short Answer Questions

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

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

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3. Explain the basic principles of the following metallurgical operations :

(i) Zone refining

(ii) Froth floatation process

(iii) Refining by liquation

(d) Vapour phase refining.

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4. Define the following terms :

(a) Roasting (b) Electro metallurgy

(C)Aluminothermy

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5. Describe how the following changes are brought about:

(i)Pig iron into steel.

(ii)Zinc oxide into metallic zinc.

(iii)Impure titanium into pure titanium.

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



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

- (a) Mond process for refining of nickel.
- (b) Column chromatography for purification of rare elements.



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8. Explain the role of the following in the processes mentioned :

- (a) Depressant in froth floatation process.
- (b) Limestone in the metallurgy of iron.



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9. Write the principle of the following

(a) Zone refining

(b) Froth floatation process

(c) Chromatography

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10. (a) Differentiate between roasting and calcination.

(b) How is cast iron different from pig iron ?

(c) Explain magnetic separation method in detail.

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11. (a) Which solution is used for the leaching of silver metal in the presence of air in the metallurgy of silver ?

(b) Out of C and CO, which is a better reducing agent at the lower temperature range in the blast furnace to extract iron from the oxide ore ?

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12. (a) Give an example of zone refining of metals.

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

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13. (a) How can copper be extracted from hydrometallurgical process ?

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14. Give Mond process for refining of nickel.

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15. (a) What are calcination and roasting ? In which type of ores are these processes used ?

(b) Which metals are generally extracted by electrolyte processes ? What position do these metals occupy in the periodic table ?

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16. Define the following terms:

(i) Ore benefaction

(ii) Hydrometallurgy

(iii) Pyrometallurgy



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17. EXTRACTION OF ALUMINIUM



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18. What type of ores can be concentrated by froth floatation process ? Explain how can the process be carried out ?



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

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

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

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20. (a) Why is zinc blende roasted before carbon reduction?

Answer with balanced chemical equation.

(b) What is malachite ? Write down its formula.

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21. How is zinc obtained from zinc blende ? Give chemical reactions.



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22. Explain the steps involved in the vapour phase refining of Ni and Zr.



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23. (a) Name the role of Na_3AlF_6 in the electrolytic reduction of alumina.

(b) How does the FeO impurity present in sulphide ore of copper is removed ?



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24. (i) Name the method of refining of metals such as Germanium.

(ii) In the extraction of Al, impure Al_2O_3 is dissolved in conc. NaOH to form sodium aluminate and leaving impurities behind. What is the name of this process?

(iii) What is the role of coke in the extraction of iron from its oxides?



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



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26. (a) What are the two requirements for vapour phase refining? Write the chemical reactions which occur during Mond's process for the refining of nickel.

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27. Name the principal ore of aluminium. Explain the significance of leaching in the extraction of aluminium.

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28. (a) Write the principle of method used for the refining of germanium

(b) Out of PbS and $PbCO_3$ (ores of lead), which one is concentrated by froth floatation process preferably?

(c) What is the significance of leaching in the extraction of aluminium ?



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29. Describe the role of

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

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

(iii) CO in the purification of Nickel.



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30. Outline the principles of refining of metals by the following methods.

(a) Zone refining (b) Electrolytic refining (c) poling (d) Vapour phase refining.



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31. (i) Name a metal refined by Van Arkel method.

(ii) Explain the process of obtaining "blister copper" from "copper matte" with equation.



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32. (i) Explain zone refining method for refining of metals.

(ii) Explain the van Arkel method for refining of metals.



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33. (i) Write composition of copper matte.

(ii) Write balanced equations for the reactions involved in the

extraction of copper from copper matte.



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34. (a) Name the method of refining which is

(i) used to obtain semiconductor of high purity.

(ii) used to obtain low boiling metal.

(b) Write chemical reactions taking place in the extraction of copper from Cu_2S .



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35. Describe the role of the following :

(i) NaCl in the extraction of silver from a silver ore

(ii) Iodine in the refining of titanium

(iii) Cryolite in the metallurgy of aluminium



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36. Match the following processes of metallurgy with their corresponding ore for which they are used :

(i) Froth floatation method

(a) Germanium

(ii) Electrolytic refining of metals

(b) ZnS

(iii) Zone refining of metals

(c) copper



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37. Describe the principle controlling each of the following processes:

(i) Vapour phase refining of titanium metal.

(ii) Froth floatation method of concentration of a sulphide ore



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

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

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



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39. Write the principle of the following

(a) Zone refining

(b) Froth floatation process

(c) Chromatography



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40. (a) Write the principle involved in the vapour phase refining of metals.

(b) Write the name of the metal refined by each of the following processes :

(i) Mond process (ii) van Arkel method

(c) What is the role of depressant in froth floatation process ?



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



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

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Hots Higher Order Thinking Skills Advanced Level

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

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2. Why the graphite rods in the extraction of aluminium from molten Al_2O_3 have to be replaced from time to time ?

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3. Why is zinc and not copper used for the recovery of metallic silver from its cyanide complex $[Ag(CN)_2]^-$?

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

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5. 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.



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



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7. Thermite process is quite useful for repairing broken parts of machines. Explain.

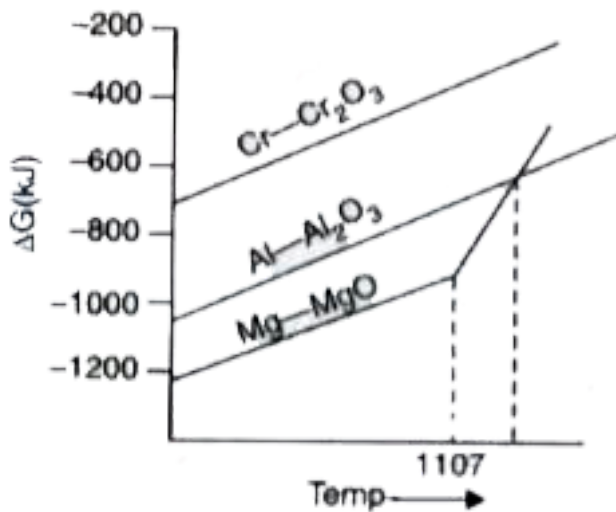


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8. The extraction of Au by leaching with $NaCN$ both oxidation and reduction. Justify giving equations.

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9. A part of Ellingham diagram is shown below :



(i) Will Cr_2O_3 be reduced by Al or not ?

(ii) Suggest a condition under which magnesium could reduced aluminium.



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



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**Competition File Objective Questions Multiple Choice Question
With Only One Correct Answer**

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

A. mud

B. slag

C. flux

D. gangue.

Answer: B



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2. Roasting is carried out in case of:

A. iron pyrites

B. galena

C. cinnabar

D. bauxite.

Answer: C



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3. The method for the purification of impure metals which is based upon the phenomenon of electrolysis is called

- A. Electrorefining
- B. Hydrometallurgy
- C. Polling
- D. Liquation.

Answer: A



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4. Coke is used in metallurgical process chiefly as

A. Flux

B. reducing agent

C. slag

D. oxidising agent

Answer: B



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5. Zone regining has been employed for preparing ultra pure samples of

A. Cu

B. Na

C. Ge

D. Zn.

Answer: C



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6. Copper pyrites are concentrated by

A. Electromagnetic method

B. Froth flotation process

C. Gravity method.

D. All the above.

Answer: B



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7. Electrolyte reduction method is used in the extraction of

- A. highly electromegative elements
- B. metalloids
- C. transition metals
- D. highly electropositive elements

Answer: D



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8. The purpose of smelting an ore is

- A. oxidise it

B. reduce it

C. obtain an alloy

D. separate volatile impurities

Answer: B



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9. Which of the following metals is obtained by leaching its ore with dilute cyanide solution ?

A. Titanium

B. Silver

C. Zirconium

D. Vanadium

Answer: B



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10. Which of the following metals cannot be extracted by carbon reduction process?

A. Pb

B. Al

C. Zn

D. Hg

Answer: B



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11. Van Arkel method of purification of metals involves converting the metal to

- A. volatile unstable compound
- B. volatile stable compound
- C. non-volatile stable compound
- D. none of the above.

Answer: B



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12. In which of the following, ore does not match with the metal ?

- A. Zinc - Calamine

B. Lead - Gypsum

C. Copper - Malachite

D. Aluminium - Bauxite

Answer: B



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13. Smelting involves reduction of metal oxide with :

A. Carbon

B. Carbon monoxide

C. Magnesium

D. Alumimum

Answer: A



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

A. Ag

B. Cu

C. Al

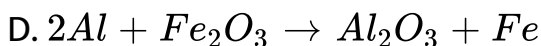
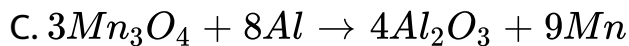
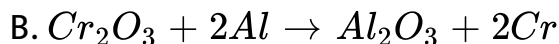
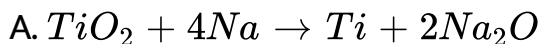
D. Cr

Answer: C



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15. Which of the following is used in thermite welding ?

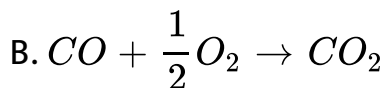
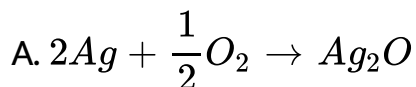


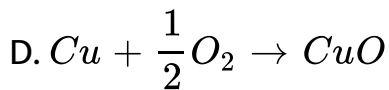
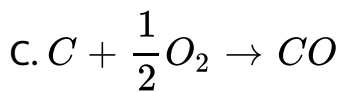
Answer: D



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16. ΔG^\ominus vs T plot in Ellingham diagram slopes downward for the reaction .





Answer: C

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17. Which of the following statement is not true?

A. The Ellingham diagram show the plots of ΔG vs T.

B. In froth floatation process depressants are added to enhance the formation of froth.

C. Extraction of zinc oxide is done by coke.

D. CO is more effective reducing agent below 983K

Answer: B



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18. From the Ellingham graphs on carbon, which of the following statements is false?

- A. CO_2 is more stable than CO at less than 983 K
- B. CO reduces Fe_2O_3 to Fe at less than 983 K
- C. CO is less stable than CO_2 at more than 983 K
- D. CO reduces Fe_2O_3 to Fe in the reduction zone of blast furnace.

Answer: C



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19. During roasting of zinc blende, it converts to

A. ZnO

B. $ZnSO_4$

C. $ZnCO_3$

D. Zn

Answer: A

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

A. Cast iron

B. Spongy iron

C. Steel

D. Wrought iron

Answer: B



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21. In blast furnace, iron oxide is reduced by

A. Carbon

B. Limestone

C. CO

D. Zinc

Answer: C



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22. The smelting of iron in a blast furnace involves all the steps except

- A. Fusion
- B. Reduction
- C. Sublimation
- D. Roasting

Answer: C



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23. Heating pyrites in air to remove sulphur is called

A. calcination

B. fluxing

C. smelting

D. roasting

Answer: D



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24. In the metallurgy of iron, when limestone is added to the blast furnace, the calcium ions end up in

A. gangue

B. slag

C. metallic calcium

D. calcium oxide

Answer: B



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

A. anode

B. cathode

C. anode or cathode

D. electrolyte

Answer: A



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Competition File Objective Questions Multiple Choice Question From Competitive Examinations

1. Which of the following statement above the advantage of roasting of sulphide ore before reduction is not true?

A. The $\Delta_f G^\circ$ of the sulphide is greater than those for

CS_2 and H_2S

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

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

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

Answer: D

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

A. Galena

B. Copper pyrite

C. Cinnabar

D. Argentite

Answer: D



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3. Which of the following pairs of metals is purified by van Arkel method?

A. Ga and In

B. Zr and Ti

C. Ag and Au

D. Ni and Fe

Answer: B



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

A. Manganese

B. Carbon

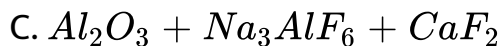
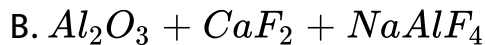
C. Silicon

D. Phosphorus

Answer: B

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



Answer: C



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

A. Malachite

B. Cassiterite

C. Pyrolusite

D. Magnetite

Answer: D



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

A. Magnetite

B. Iron pyrites

C. Copper glance

D. Sphalerite

Answer: A



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8. Roasting of sulphides gives the gas X as a by product. This is a colourless gas with choking smell of burnt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic, acts as reducing agent and its acid has never been isolated. The gas X is :-



Answer: D



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9. Sphalerite is concentrated by

- A. gravity separation
- B. froth floatation
- C. magnetic separation
- D. hydraulic washing

Answer: B



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10. In the extraction of copper from its sulphide ore, the metal finally obtained by the reduction of cuprous oxide with -

- A. Copper (I) sulphide (Cu_2S)

B. sulphur dioxide (SO_2)

C. iron sulphide (FeS)

D. carbon monoxide (CO)

Answer: A



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

I. Metal nitrates are highly unstable.

II. Metal nitrates are highly soluble in water.

A. A and B are false

B. A is false but B is true

C. A is true but B is false

D. A and B are true.

Answer: B

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12. Match the items of Column I with item of Column II and assign the correct code.

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

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

- A. distillation
- B. zone refining
- C. displacement of Zn
- D. liquation

Answer: C

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

A. Fe

B. Zn

C. Mg

D. Cu

Answer: C



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15. Which one is malachite from the following

A. $CuCO_3 \cdot Cu(OH)_2$

B. $CuFeS_2$

C. $Cu(OH)_2$

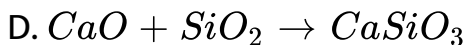
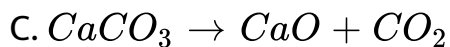
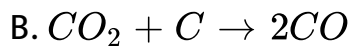
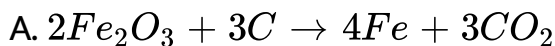
D. Fe_3O_4

Answer: A



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



Answer: C



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17. In the aluminothermite process, Al acts as :

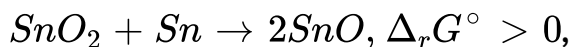
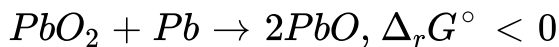
- A. Reduction agent
- B. Oxidising agent
- C. Catalyst
- D. Electrolyte

Answer: A



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



which oxidation states are more characteristic for lead and tin

?

A. For lead + 2, for tin + 2

B. For lead + 4, for tin + 4

C. For lead + 2, for tin + 4

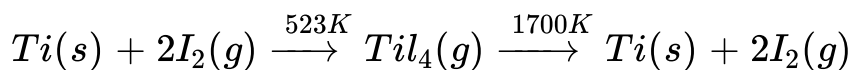
D. For lead + 4, for tin + 2

Answer: C



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



A. Cupellation

B. Poling

C. Van Arkel

D. Zone refining

Answer: C



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20. The function of potassium ethyl xanthate in froth floatation process is to make the ore

A. attracted towards water

B. water repellent

C. lighter

D. heavier

Answer: B



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21. The first step in the extraction of copper from copper pyrites

- A. reduction by carbon
- B. electrolysis of ore
- C. roasting of ore in O_2
- D. magnetic separation

Answer: C



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22. The statement that is not correct is

- A. a furnace lined with haematite is used to convert cast iron to wrought iron.
- B. collectors enhance the wettability of mineral particles during froth floatation.
- C. in vapour phase refining the metal should form volatile compound.
- D. copper from its low grade ores is extracted by hydrometallurgy.

Answer: B



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23. Roasted copper pyrite on smelting with sand produces

- A. $FeSiO_3$ as fusible slag and Cu_2S as matte
- B. $CaSiO_3$ as in fusible slag and Cu_2O as matte
- C. $Ca_3(PO_4)_2$ as fusible slag and Cu_2S as matte
- D. $Fe_3(PO_4)_2$ as infusible slag and Cu_2S as matte

Answer: A



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

- A. Al^{3+} is reduced at the cathode to form Al .
- B. Na_3AlF_6 serves as the electrolyte.
- C. CO and CO_2 are produced in this process.

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

Answer: B

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

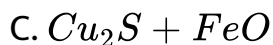
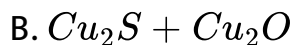
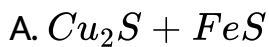
- A. Magnetite
- B. Siderite
- C. Galena
- D. Malachite

Answer: C



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

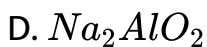
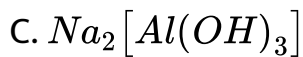
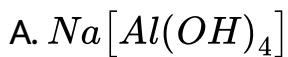


Answer: A



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



Answer: A



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28. The metal extracted by leaching with cyanide is

A. Cu

B. Al

C. Na

D. Ag

Answer: B



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29. Purification of aluminium is called

- A. Hall's process
- B. froth floatation Process
- C. Serpeck's process
- D. Hoopé's process

Answer: D



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30. Electrolytic refining's is ued to purify which of the following metals?

A. Cu and Zn

B. Ge and Si

C. Zr and Ti

D. Zn and Hg

Answer: A



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31. the common impurities present in bauxite are

A. CuO

B. ZnO

C. Fe_2O_3

D. Cr_2O_3

Answer: C



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32. Carnallite is an ore of

A. K

B. Na

C. Mg

D. (a) and (c)

Answer: D



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33. Which of the following is not a mineral of iron?

A. Corundum

B. Limonite

C. Magnetite

D. Haematite

Answer: A



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34. The one that is not a carbonate ore is:

A. bauxite

B. siderite

C. calamine

D. malachite

Answer: A



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35. Match the refining methods (Column I) with metals (Column II).

Column I
(Refining methods)
(I) Liquefaction
(II) Zone refining
(III) Mond process
(IV) Van Arkel method

Column II
(Metals)
(A) Zr
(B) Ni
(C) Sn
(D) Ga

- A. (I) - (B), (II)-(C), (III) - (D), (IV) - (A)
- B. (I) - (B), (II) - (D), (III) - (A), (IV)-(C)
- C. (I) - (C), (II) - (A), (III) - (B), (IV) - (D)
- D. (I) - (C), (II) - (D), (III) - (B), (IV) - (A)

Answer: D

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36. The correct statement is :

- A. leaching of bauxite using concentrated NaOH solution gives sodium aluminate and sodium silicate
- B. the blistered appearance of copper during the metallurgical process is due to the evolution of CO_2
- C. pig iron is obtained from cast iron
- D. the Hall-Heroult process is used for the production of aluminium and iron

Answer: A



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37. The pair that does NOT require calcination is :

A. ZnO and MgO

B. Fe_2O_3 and $CaCO_3 \cdot MgCO_3$

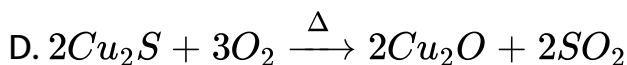
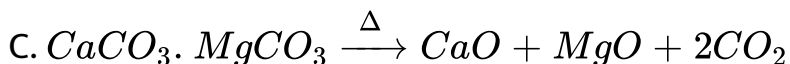
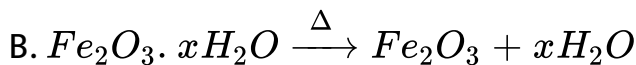
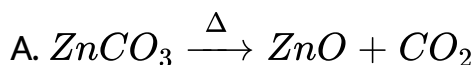
C. ZnO and $Fe_2O_3 \cdot xH_2O$

D. $ZnCO_3$ and CaO

Answer: A

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38. The reaction that does NOT define calcination is :



Answer: D



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39. Match the ores (Column A) with the metals (Column B) :

**Column-A
(Ores)**

- (I) Siderite
- (II) Kaolinite
- (III) Malachite
- (IV) Calamine

**Column-B
(Metals)**

- (A) Zinc
- (B) Copper
- (C) Iron
- (D) Aluminium

A. I-B , II-C , III-D , IV-A

B. I-C , II-D , III-A , IV-B

C. I-C , II-D , III-B , IV-A

D. I-A , II-B , III-C , IV-D

Answer: C



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40. in the Hall -Heroult process, aluminium is formed at the anode , the cathode is made out of :

- A. Carbon
- B. Copper
- C. Platinum
- D. Pure aluminium.

Answer: A



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41. The correct statement is

- A. zincite is a carbonate ore
- B. aniline is a froth stabilizer
- C. zone refining process is used for the refining of titanium
- D. sodium cyanide cannot be used in the metallurgy of silver

Answer: B



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42. Assertion : For the extraction of iron, haematite are is used.

Reason : Haematite is a carbonate are is used

- A. only the reason is correct

B. both the assertion and reason are correct and the reason is the correct explanation for the assertion.

C. only the assertion is correct

D. Both the assertion and reason are correct, but the reason is not the correct explanation for the assertion.

Answer: C



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43. The ore that contains both iron and copper is :

A. malachite

B. dolomite

C. azurite

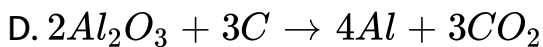
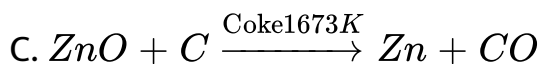
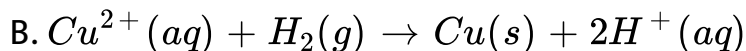
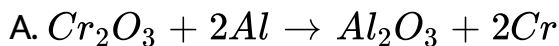
D. copper pyrites

Answer: D



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44. Hall-Heroult's process is given by :



Answer: D



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45. Extraction of zinc from zinc blende is achieved by:

- A. Electrolytic reduction
- B. Roasting followed by reduction with carbon
- C. Roasting followed by reduction with another metal
- D. Roasting followed by self reduction.

Answer: B



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

- A. II, III 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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47. In the cyanide extraction process of silver from argentite ore, the oxidising and reducing agents are

A. O_2 and CO respectively

B. O_2 and Zn dust respectively

C. HNO_3 and Zn dust respectively

D. HNO_3 and CO respectively

Answer: B



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48. Sulphide ores are common for the metals

A. *Ag, Cu* and *Pb*

B. *Ag, Cu* and *Sn*

C. *Ag, Mg* and *Pb*

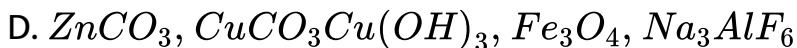
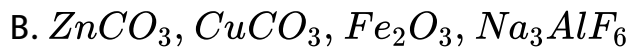
D. *Al, Cu* and *Pb*

Answer: A



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49. Calamine, malachite, magnetite and cryolite, respectively, are



Answer: A



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Competition File Objective Questions Multiple Choice Question
With More Than One Correct Answers

1. Leaching process can be used for concentration of ores of

A. aluminium

B. Copper

C. gold

D. iron

Answer: A::C



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2. Van Arkel method of refining is used for

A. zirconium

B. silicon

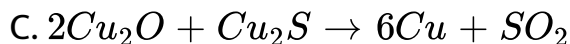
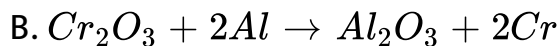
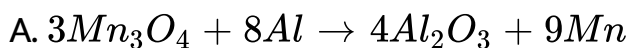
C. germanium

D. titanium

Answer: A::D

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3. Which of the following is/are not example of thermite reaction ?



Answer: C::D



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4. Which of the following oxide cannot be reduced to metal by carbon ?

A. ZnO

B. Al_2O_3

C. CuO

D. MgO

Answer: A::C



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5. Extraction of metal from the ore cassiterite involves

- A. carbon reduction of an oxide ore
- B. self-reduction of a sulphide ore
- C. removal of copper impurity
- D. removal of iron impurity.

Answer: B::D



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

- A. $CuFeS_2$
- B. CuO
- C. Cu_2O

D. $CuSO_4$

Answer: B::C::D



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7. Copper is purified by electrolytic refining of bliter copper

.The current stetemnt about this process is (are):

(i) impure Cu strip is used as cathode

(ii) acidified aqueous $CuSO_4$ is used as electrolyte

(iii) pure Cu deposits at eathode

(iv) impurities settle as anode -mud

A. impure Cu strip is used as cathode

B. acidified aqueous $CuSO_4$ is used as electrolyte

C. pure Cu deposit at cathode

D. impurities settle as anode-mud

Answer: B::C::D



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

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

B. removal of iron as slag

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

D. refining of 'blister copper' by carbon reduction

Answer: A::B::C



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9. The major role of fluorpar (CaF_2) which added in small quantities in the electrolyte reduction of alumina dissolved in fused cryolite (N_3AlF_6) is

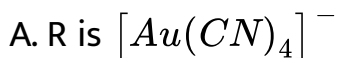
- A. as a catalyst
- B. to make fused mixture conducting
- C. to lower the melting temperature of the mixture
- D. to decrease the rate of oxidtion of carbon at anode.

Answer: B::C



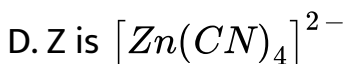
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10. The cyanide process of gold extraction involves leaching out gold from its ore with CN^- in the presence of Q in water to form R. Subsequently, R is treated with T to obtain Au and Z. Choose the correct option (s)



B. T is Zn

C. Q is O_2



Answer: B::C::D



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1. Match the metal in Column I with the ores in Column II

Column I	Column II
(A) Aluminium	(p) Siderite
(B) Zinc	(q) Malachite
(C) Copper	(r) Sphalerite
(D) Iron	(s) Bauxite

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2. Match the extraction process in column I with the metal in column II.

Column I	Column II
(A) Carbon reduction	(p) Gold
(B) Self reduction	(q) Copper
(C) Electrolytic reduction	(r) Aluminium
(D) Complex formation followed by displacement by metal	(s) Lead

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3. Match the anionic species given in Column I that are present in the ore(s) given in Column II.

Column I	Column II
(A) Carbonate	(p) Siderite
(B) Sulphide	(q) Malachite
(C) Hydroxide	(r) Bauxite
(D) Oxide	(s) Calamine
	(t) Argentite

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Competition File Integer Type Numerical Value Type Questions

1. Amongst following, total number of metals which occur in native state in the earth's crust are : Pt, Ni, C, Hg, S, Zn, Au, Pb

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2. Amongst the following the metals which are roasted to convert them into their correspondign metal oxides are : Zinc blende, iron pyrits, alumina , calamine, copper pyrites, galena , pyrolusite, malachite.

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3. Amongst the following the oxide ores are :

pyrolusite , haematite, bauxite, zincite, cinnabar, magnesite, cuprite, azurite, siderite.

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4. Amongst the following the metals which can be refined by vapour phase refining are :

Zn, Cu, Ti, Ni, Co, Al, Zr



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



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