CHEMISTRY

BOOKS - PEARSON IIT JEE FOUNDATION

METALLURGY

Example

1. Extraction of metals always involves reduction processes. Explain.

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2. Green wooden poles are used during the process of refining of copper. What purpose do they serve?

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3. Reduction of alumina that is obtained, either by Hall's proces or Bayer's process, to aluminium metal is carred out by electrolysis. During this process, cryolite and fluorspar are added to alumina, the entire mixture is covered with coke powder.

(i) Why can alumina not be directly electrolysed?

(ii) What is the role of addition of cryolite and fluorspar?

(iii) What are the different cathodic and anodic reaction taking place during electrolysis?

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4. In L-D converter pure oxygen is used for oxidation while in Bessemer process air is used for the same purpose. Which of these is better and why?

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5. Wrought iron is more malleable than cast iron. Give reason.

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6. What is meant by blister copper? What is the reason for the formation of blister copper?

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Very Short Answer Type Questions

1. What is metallurgy?

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2. The mineral from which a metal can be extracted profitably is called _____.

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3. What are the different steps of metallurgical processes?

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

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5. What is Pulverisation?

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6. Which metal has its ore concentrated chemically?

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7. Distinguish between calcination and roasting.

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8. What type of ore is conecntrated using forth floatation process?

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9. What is zinc spelter? How is it purified?

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10. How is alumina melted in the electrolytic extraction process of molten alumina?

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11. What is the process called when ZnS is converted to ZnO during the extraction of zinc?

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12. How can aluminium be used in the extraction processes of metals?

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13. How are slag and metal separaated from blast furnace?

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14. The region in the blast furnace where the temperature range is $1500^{\circ}C$ to $2000^{\circ}C$ is called_____

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15. Which is the purest form of iron? How is it useful?

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16. What are the major products and by-products of blast furnace in the extraction of iron?

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17. What type of changes take place in the property of steel if the carbon content is more?

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18. Zinc on reaction with steam liberates _____ gas.

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19. Polling method is generally employed to ____ with _____ as impurity.

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20. Copper on reaction with moist air gives _____.

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21. Alnico is an alloy of Al, Ni, Co and _____.

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22. Which method is employed for the concentration of copper pyrites?

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23. Magnalium is an alloy of _____ and _____.

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24. Refining of zinc and mercury is carried out by using _____ procoess.

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Short Answer Type Questions

1. What is the basic purpose of roasting and calcination? Compare these two processes.

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2. How does bauxite get concentrated in the extraction of alumininum? Explain?

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3. Compare cast iron, steel and wrought iron.

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4. What is meant by blister copper? Why is it called so?

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Essay Tpye Questions

1. Describ an smelting of iron in blast furnace. Write all the reactions that take place in different zones of blast furnace.

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Level 1

1. In calcination and roasting, volatile impurities are removed.

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2. Metals that have low melting point are refined by liquation.

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3. Mrecuric oxide is reduced by thermal decomposition.

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4. Monel metal is an alloy of Cu, Ni and Fe.

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5. In the upper region of blast furnace _____ helps in the reduction of iron oxide into iron.

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6. In Bessemer converter _____ is removed as phosphate slag.

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7. _____ and _____ are partially oxidised during roasting in the extraction of copper.

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8. Iron pyrites are converted to iron oxide by the process of _____.

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9. The reaction that is not asscoiated with the middle region of blast furnace during smelting is _____.

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10. Chromium and manganese oxides are reduced to metals by using _____.

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11. The components in solder are _____.

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12. Electromagnetic separation is employed for the concentration of those ores in which

A. (a) the ore is magnetic

B. the gangue is magnetic

C. both the ore and the gangue are magnetic

D. either the ore or the gangue is magnetic

Answer: D

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13. The following flow chart represents the extraction of _____.

$$\text{Froth flotation} \downarrow \text{Roasting} \downarrow \text{Smelting} \downarrow \text{Bessemerisation} \downarrow \text{Electrolytic refining}$$

A. copper

B. zinc

C. iron

D. aluminium

Answer: A

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14. In the extration of iron, the most preferred ores are

A. hematite and limonite

B. copper pyrites and siderite

C. magnetite and iron pyrites

D. limonite and copper pyrites

Answer: A

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15. An ore contains arsenic and antimony as impurities. How are they removed during the process of roasting?

A. by conversion into As_2O_3 and Sb_2O_3

B. by concersion into As_2O_5 and Sb_2O_5

C. by conversion into both trioxides and pentoxides

D. by conversion into sulphides

Answer: A

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16. Aluminium is added in Bessmer process to remove certain impurities, but not in L-D process. This is because

A. pure oxygen is passed in Bessemer process

B. pure oxygen is passed in L-D process

C. air is passed in L-D process

D. of addition of spiegel in Bessemer process

Answer: B

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17. Which among the following is an oxide ore of lead?

A. led ochre

B. galena

C. anglesite

D. dolomite

Answer: A

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18. Zinc is refined by

A. liquation (or) distillation under reduced pressure

B. electrolytic method or polling

C. liquation or electrolytic method

D. distillation under reduced pressure or electrotytic method

Answer: D

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19. Lustre of metal is attributed to

A. loosely bond electrons present in the valence shell of the metal atoms

B. strong electrostatic force of attaction between electrons and metal kernels

C. omnidirectional nature of metallic bond

D. none of the above

Answer: A

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20. The volatile impurities associated with zinc spelter are _____.

A. Cd and Fe

B. Fe and As

C. Cd and C

D. Cd and As

Answer: D

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21. The process employed for the purification of copper with cuprous oxide as the impurity is

A. polling

B. liquation

C. electrolytic process

D. oxidation

Answer: A

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22. Alclad' is perfectly resistant to corrosion by sea water. The alloy is

A. magnalium coated with aluminium

B. duralumin coated with aluminium

C. r-alloy duralumin

D. a mixture of magnalium and duralumin

Answer: B

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23. Hardened steel on heating in the range from 220 to $330^\circ C$ and on slow cooling gives

A. hard steel

B. brittle steel

C. hard and brittle steel

D. hard and tough steel

Answer: D

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24. If an ore contains impurity of SiO_2, identify the appropriate flux for the removal of it

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25. In the electrolytic reduction of alumina, the electrolyte is covered with coke powder because it

A. prevents oxidation of aluminium formed

B. reacts with aluminium forming aluminium carbide

C. prevents heat loss from the electrolyte

D. none of the above

Answer: C

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26. Sequence the following steps involved generally in the extraction of a metal in pure form from its ore, the extraction of a metal in pure form from its ore.

(1) The metal obtained from its oxide requires further purification for end use.

(2) The ore shoud be converted to its oxide form.

(3) The ore is beneficial to us if it is hand-picked then metal crushed and ground, and later subjected to Pulverisation as per the requirement.

(4) The ore in the form of oxide is required to be reduced.

(5) Dressed ore is required for it to be concentrated.

A. 5 3 2 4 1

B. 3 5 2 4 1

C. 3 5 2 1 4

D. 3 5 4 2 1

Answer:

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27. Select the stepe requried for the extraction of aluminium and sequence them.

(1) froth flotation

(2) chemical separation

(3) electrolytic reduction

(4) smelting

(5) distillation under low pressure

(6) electrolytic refining

(7) Pulverisation

(8) conversion of concentrated ore into oxide

(9) crushing and grinding

A. 9 5 7 2 3 8 6 1

B. 3 2 1 4 5 6 7 8

C. 9 7 2 8 3 6

D. 9 7 2 3 8 6

Answer:

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28. The reactions given below represent the processes of reduction to obtain metals from their respective

ores. Arrange them in the following order.

Sodium, aluminium, zinc, chromium, iron, copper and mercry

(1) Metal oxide + metal sulphide $\rightarrow$ Metal + SO_2

(2) Metal oxide + CO $\rightarrow$ Metal + CO_2

(3) Metal oxide + C $\rightarrow$ CO

(4) Metal oxide $\rightarrow$ Metal + O_2

(5) Meta oxide $\xrightarrow{\Delta}$ Metal + O_2

(6)

$\text{Metal oxide} + \text{Aluminium} \rightarrow \text{Aluminium oxide} + \text{Metal}$

(7) Metal chloride $\rightarrow$ Metal + Chlorince

A. 7 4 3 6 2 1 5

B. 7 4 3 6 2 5 1

C. 1 3 2 4 6 7 5

D. 7 4 5 2 6 1 5

Answer:

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29. $X + CuSO_4 \rightarrow XSO_4 + Cu$,

$Y + CuSO_4 \rightarrow YSO_4 + Cu$, in these reactions X and Y may be _____ .

A. Zn, Ag

B. Zn, Fe

C. Fe, Ag

D. Ag, Al

Answer:

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30. The compositio of thermite mixture is

A. iron (III) oxide and aluminium powder in the rato 1 : 3

B. aluminium powder and iron (III) oxide in the ratio 1 : 3

C. aluminium powder and barium peroxide in the ratio 1 : 3

D. barium peroxide and aluminium in the ratio 1 : 3

Answer:

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31. The order of procsses involved in the dressing of an ore is

(i) grinding and crushing (ii) hand-picking

(iii) Pulverisation

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

B. (i), (iii), (ii)

C. (ii), (iii), (i)

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

Answer:

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32. Chemical seqaration is one of the methods employed in

A. dressing of ore

B. concentration of ore

C. extraction of metal from its oxide

D. conversion ore to oxide

Answer:

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33. Aluminium liberates hydrogen gas on reaction with

A. concentrated sulphuric acid

B. nitric acid

C. hydrochloric acid

D. none of these

Answer:

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34. The reaction that is not asscoiated with the middle region of blast furnace during smelting is _____.

A. $CO_2 + C \rightarrow 2CO$

B. $CaCO_3 \rightarrow CaO + CO_2$

C. $CaO + SiO_2 \rightarrow CaSiO_3$

D. $C + O_2 \rightarrow CO_2$

Answer:

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35. Gas liberated when zinc is treated with concentrated nitric acid is _____ .

A. nitrous oxide

B. nitric oxide

C. nitrogen dioxide

D. nitrogen

Answer:

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36. Bell metal is an alloy of _____.

A. Cu, Zn

B. Cu, Pb

C. Cu ,Sn

D. Cu, Ni

Answer:

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37. Identify the metal that reacts with concetrated H_2SO_4 or HNO_3, but not with concentrated HCl.

A. Fe

B. Zn

C. Cu

D. Al

Answer:

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38. Which of the following metals is soft in nature?

A. platinum

B. iron

C. aluminium

D. sodium

Answer:

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39. Which of the following metals forms amphoteric oxide when it reacts with oxygen?

A. sodium

B. magnesium

C. aluminium

D. potassium

Answer:

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40. Which among the following metals is not present in german silver?

A. Cu

B. Ag

C. Zn

D. Ni

Answer:

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Level 2

1. Why is it necessary to replace carbon anode from time to time in the electrolytic extraction of aluminium ?

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2. Why are more electropositive elements extracted only by electrolytic reduction?

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3. What is the role of cryolite and fluorspar during the extraction of aluminium? However, addition of these produces a harmful gas. Explain.

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4. In the process of reduction of concentrated ore to zinc spelter, ZnO is made into briquettes. Give reason.

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5. Why are most of the metals hard and have high melting and boiling points?

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6. Explain the principle involved in the purification of red bauxite by Bayer's process.

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7. Zinc, aluminium and iron give different products when reacted with sulphuric acid of different strengths (dilute and concentrated), whereas copper reacts only with concentrated sulpuric acid. Justify.

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8. Give reasons: Aluminium alloys are used to make aircraft body.

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9. Why is the iron obtained from the blast furnace not used for making any articles?

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10. Metal articles to be eletroplated are treated with HCl or H_2SO_4 before electrolysis. Give reasons.

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11. Expain the role of aluminium in the extraction of chromium or manganese.

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12. Which property of Mn of the alloy spiegel is exploited in the manufacture of steel?

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13. What is the effect of Cu on the ZnAl alloys?

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14. How are the noble metals containing other metals as impurities purified?

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15. One day Dimpy visited an aluminium industry with her father. She found that molten alumina was taken in the fused state for electrolytic reduction process. She asked her father the reason for using fused alumina as an electronlyte instead of the solution of aluminium salt, although the latter can save ample amount fo energy. Dimpy's father was plasesd with her concern for saving energy hence he explained to her why nothing could be done about that wastage of energy in that particular instance. What could be his explanation?

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16. A, B C and D are four metals. Both A and B react with concentrated alkali and also with steam. Reaction of A with steam is rapid in the beginning and becones slow later. Oxide of C on treatment with A liberates huge amount of heat and C produces borwn-coloured flakes on exposure to humid atmosphere. D forms two types of oxides below 1370 K and above 1370 K. Identify A, B, C and D and write all the balanced chemical equations.

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17. Explain the role of coke and sand added during smelting process in the extraction of copper.

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18. Auro, a 10th standard student was asked to identify iron, copper, zinc and aluminium only by observing the effect of action of concentrated nitric acid and caustic soda on each metal. How did he put the eractions of these metals with each of the reagents?

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19. Two samples of iron, A and B were given to two students, Rini and Riki, respectvely. One of the samples is wrought iron and the other is pig iron. They were asked to observe and study their properties. Rini found that the sample given to her broke easily, whereas Riki's sample was more malleable. Apart from this, it was observed that Rini's sample could be welded at a relatively lower temperaure than Riki's sample. Based on the above observations, identify A and B and justify your answer.

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20. During metallurgy of iron its, ore coke and limestone are added to the blast furnace.

(a) What is the role of limestone?

(b) Identify the reducing agent in the extraction of iron during the above process.

(c) Identifly slag formed during the above process.

(d) What are the different gases liberated in this process?

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Level 3

1. Addition of cryolite and fluorspar to alumina produces a dangerous by-product'. Comment.

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2. Why L-D process is preferred to Bassemer process?

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3. The alloy alnico finds application in the instruments that requires a very stable temperature.

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4. During the quenching of steel, it is plunged eitherintor a water bath or in an oil bath. Explain why different baths are used.

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5. Why is brass preferred to stainless steel for door settings?

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6. In spite of the addition of cryolite and fluorspar to alumina only Al^{+3} and O^{-2} ions are discharged at

their respective electrodes. Justify.

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7. Explain what happens if bauxite containing iron oxide and silica as impurities is directly subjected to the process of electrolytic reduction without prior purification.

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8. The presence of phosphours is harmful during the manufacture of steel. Give reasons.

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9. Steel manufactured using the open hearth process is of better quality compared to steel maunfactured by Bessemer process and L-D converter. Give reasons.

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10. Ms Joan was teaching metallurgy in a class. She taught her students how an intensely heated steel ingot when plunged into a water bath or an oil bath can acquire different properties. Then she asked the students the reason for using different cooling

agents. What would be your answer for making use do different cooling agents?

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