General Principles And Processes Of Isolation Of Elements

Question1

The reaction that does NOT take place in a blast furnace between 900K to 1500K temperature range during extraction of iron is :

[NEET 2023]

Options:

A.

$FeO + CO \rightarrow Fe + CO_2$

B.

$C + CO_2 \rightarrow 2CO$

C.

$CaO + SiO_2 \rightarrow CaSiO_3$

D.

$Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

Answer: D

Solution:

At $900 - 1500K$ (higher temperature range in the blast furnace)

Reaction which take place are :-

$C + CO_2 \rightarrow 2\,CO$

$FeO + CO \rightarrow Fe + CO_2$

$CaO + SiO_2 \rightarrow CaSiO_3$ (Slag formation)

$Fe_2O_3 + CO \rightarrow 2\,FeO + CO_2 \rightarrow$ This take place at $500 - 800K$

Question2

Match List-I with List-II

List-I(Mixtures/Sample)	List-II (Technique used for purification)
(A) Glycerol from spent lye	(I) Steam distillation
(B) ChloroformAniline	(II) Fractional distillation

(C) Fractions of crude oil	(III) Distillation under reduced pressure
(D) Aniline + Water	(IV) Distillation

Choose the correct answer from the options given below:

[NEET 2023 mpr]

Options:

A.

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

B.

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

C.

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

D.

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

Answer: A

Solution:

(A) Glycerol from spent lye → Distillation under reduced pressure

(B) Chloroform + Aniline → Distillation

(C) Fractions of crude oil → Fractional distillation

(D) Aniline $^{+}H^{2}O$ → Steam distillation

Question3

Read the following statements and choose the set of correct statements :
(A) Chrome steel is used for cutting tools and crushing machines.
(B) The fine dust of aluminium is used in paints and lacquers.
(C) Copper is used for reduction of alcohol
(D) Zinc dust is used as a reducing agent in the manufacture of paints
(E) Iron is used for galvanising zinc

Choose the most appropriate answer from the options given below :

[NEET 2023 mpr]

Options:

A.

(D) and (E) only

B.

(A) and (D) only

C.

(A), (B) and (D) only

D.

(B), (C) and (D) only

Answer: C

Solution:

Uses in metallurgy (NCERT)

Question4

Match List-I with List-II.

List-I (Ores)	List-II (Composition)
(a) Haematite	(i) Fe_3O_4
(b) Magnetite	(ii) $ZnCO_3$
(c) Calamine	(iii) Fe_2O_3
(d) Kaolinite	(iv) $[Al_2(OH)_4Si_2O_5]$

Choose the correct answer from the options given below: [NEET-2022]

Options:

A. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

B. (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

C. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

D. (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

Answer: B

Solution:

Solution:

(Ores)	(Composition)
(a) Haematite	$\rightarrow Fe_2O_3$
(b) Magnetite	$\rightarrow Fe_3O_4$
(c) Calamine	$\rightarrow ZnCO_3$
(d) Kaolinite	$\rightarrow [Al_2(OH)_4Si_2O_5]$

Question5

Which one of the following is not a calcination reaction? [NEET Re-2022]

Options:

A. $CaCO_3 + 2\,HCl \xrightarrow{\Delta} CaCl_2 + H_2O + CO_2$

B. $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

C. $Fe_2O_3 \cdot xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

D. $CaCO_3 \cdot MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

Answer: A

Solution:

Solution:

Calcination involves heating in absence of air and the volatile matter escaped leaving behind the metal oxide

$ZnCO_{3(s)} \xrightarrow{\Delta} ZnO_{(s)} + CO_{2(g)}$

$Fe_2O_3 \cdot XH_2O \xrightarrow{\Delta} Fe_2O_{3(s)} + XH_2O_{(g)}$

$CaCO_3 \cdot MgCO_3 \xrightarrow{\Delta} CaO_{(s)} + MgO_{(s)} + 2CO_{2(g)}$

Question6

Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature? [NEET 2021]

Options:

A. Electrolysis

B. Chromatography

C. Distillation

D. Zone refining

Answer: C

Solution:

Solution:
Distillation method is generally used for the purification of metals having low boiling point such as Hg, Zn etc.

Question7

The maximum temperature that can be achieved in blast furnace is : [NEET 2021]

Options:

A. Upto 1200 K

B. Upto 2200 K

C. Upto 1900 K

D. Upto 5000 K

Answer: B

Solution:

Solution:
Maximum temperature that can be achieved in blast furnace is upto 2200 K.
(As per NCERT text: 2170 K maximum temperature is given in the figure of blast furnace)

Question8

Identify the correct statement from the following: [2020]

Options:

A. Blister copper has blistered appearance due to evolution of CO_2 .

B. Vapour phase refining is carried out for Nickel by Van Arkel method.

C. Pig iron can be moulded into a variety of shapes.

D. Wrought iron is impure iron with 4% carbon

Answer: C

Solution:

The iron obtained from blast furnace contains about 4% carbon and smaller amount of impurities like S, P, Si, Mn. This form of iron is known as pig iron. It can be moulded into variety of shapes. Blister copper has blistered appearence due to evolution of SO_2.van Arkel method is used for refining of Zirconium or Titatanium.

Question9

Which one is malachite from the following? (NEET 2019)

Options:

A. $CuCO_3 . Cu(OH)_2$

B. $CuFeS_2$

C. $Cu(OH)_2$

D. Fe_3O_4

Answer: A

Question10

Identify the incorrect statement. (Odisha NEET 2019)

Options:

A. The scientific and technological process used for isolation of the metal from its ore is known as metallurgy.

B. Minerals are naturally occurring chemical substances in the earth's crust.

C. Ores are minerals that may contain a metal.

D. Gangue is an ore contaminated with undesired materials.

Answer: D

Question11

Considering Ellingham diagram, which of the following metals can be used to reduce alumina?
(NEET 2018)

Options:

A. Fe

B. Zn

C. Mg

D. Cu

Answer: C

Solution:

Solution:
Any metal oxide with lower value of ΔG° is more stable than a metal oxide with higher ΔG°. This implies that the metal oxide placed higher in the Ellingham diagram can be reduced by the metal involved in the formation of the oxide placed lower in the diagram.
The relative tendency of the various metals to act as reducing agents is :Ca > Mg > Al > Cr >Zn > Fe > Cu
Thus, Mg being more reducing in nature, can reduce aluminium oxide (alumina).

Question12

Extraction of gold and silver involves leaching with CN^- ion. Silver is later recovered by
(NEET 2017)

Options:

A. distillation

B. zone refining

C. displacement with Zn

D. liquation.

Answer: C

Solution:

Extraction of gold and silver involves leaching the metal with CN^- and the metals silver and gold are later recovered by displacement method.

$4M_{(s)} + 8CN^-_{(aq)} + 2H_2O_{(aq)} + O_{2(g)} \rightarrow 4[M(CN)_2]^-(aq) + 4OH^-(aq)$

$2[M(CN)_2]^-(aq) + Zn_{(s)} \rightarrow 2M_{(s)} + [Zn(CN)_4]^{2-}(aq)$

Question13

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

Column I	Column II
(A) Cyanide process	(i) Ultrapure Ge
(B) Froth floatation process	(ii) Dressing of ZnS
(C) Electrolytic reduction	(iii) Extraction of Al
(D) Zone refining	(iv) Extraction of Au
	(v) Purification of Ni

(NEET-I 2016)

Options:

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

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

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

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

Answer: C

Solution:

Solution:

Question14

In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with (2015, 2012)

Options:

A. carbon monoxide

B. copper (I) sulphide

C. sulphur dioxide

D. iron (II) sulphide.

Answer: B

Solution:

Solution:
$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

Question15

“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.
(2015 Cancelled)

Options:

A. I is false but II is true.

B. I is true but II is false

C. I and II are true.

D. I and II are false.

Answer: A

Solution:

Solution:
All nitrates are soluble in water and are quite stable as they do not decompose easily on heating.

Question16

Roasting of sulfides gives the gas X as a by-product. This is a colorless 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 a reducing agent and its acid has never been isolated. The gas X

is
(2013 NEET)

Options:

A. CO_2

B. SO_3

C. H_2S

D. SO_2

Answer: D

Question17

The metal oxide which cannot be reduced to metal by carbon is (Karnataka NEET 2013)

Options:

A. Al_2O_3

B. PbO

C. ZnO

D. Fe_2O_3

Answer: A

Solution:

Solution:
Oxides of less reactive metals (like PbO, ZnO, Fe_2O_3) can be reduced by carbon. While oxides of very reactive metals (like Al_2O_3) can be reduced only by the electrolytic method.

Question18

Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of

(2012)

Options:

A. $Al_2O + HF + NaAlF_4$

B. $Al_2O_3 + CaF_2 + NaAlF_4$

C. $Al_2O_3 + Na_3AlF_6 + CaF_2$

D. $Al_2O_3 + KF + Na_3AlF_6$

Answer: C

Solution:

Solution:
Electrolytic mixture contains alumina (Al_2O_3), cryolite (Na_3AlF_6) and fluorspar (CaF_2) in the ratio of 20 : 40 : 20. Due to presence of these, conductivity of alumina increases and fusion temperature decreases from 2000°C to 900°C.

Question19

Which one of the following is a mineral of iron?
(2012)

Options:

A. Malachite

B. Cassiterite

C. Pyrolusite

D. Magnetite

Answer: D

Solution:

Solution:
Magnetite is Fe_3O_4 and contains upto 70% of the metal

Question20

Which of the following elements is present as the impurity to the maximum extent in the pig iron?
(2011)

Options:

A. Manganese

B. Carbon

C. Silicon

D. Phosphorus

Answer: B

Solution:

Solution:
Pig iron contains about 4% carbon and many impurities such as Mn, P, Si, etc. in minor amount.

Question21

Which of the following pairs of metals is purified by van Arkel method? (2011)

Options:

A. Ga and In

B. Zr and Ti

C. Ag and Au

D. Ni and Fe

Answer: B

Solution:

Solution:
van Arkel method is used for purification of Zr and Ti.

Question22

The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.
(2011 Mains)

Options:

A.

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

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

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

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

Answer: C

Solution:

Slag is formed by the reaction.
$CaO(s) + SiO_{2(s)} \rightarrow CaSiO_3(s)$

Question23

Sulfide ores of metals are usually concentrated by froth floatation process. Which one of the following sulphide ores offer an exception and is concentrated by chemical leaching?
(2007)

Options:

A. Galena

B. Copper pyrite

C. Sphalerite

D. Argentite

Answer: D

Solution:

Leaching process involves the treatment of the ore with a suitable reagent as to make it soluble while impurities remain insoluble. The ore is recovered from the solution by suitable chemical method. Argentite or silver glance,Ag_2S is an ore of silver. Silver is extracted from argentite by the Mac-Arthur and Forest process (leaching process).
$Ag_2S + 4NaCN \rightleftharpoons 2Na[Ag(CN)_2] + Na_2S$
$2Na[Ag(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2Ag$

Question24

Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true? (2007)

Options:

A. The ΔG°_f of the sulphide is greater than those for CS_2 and H_2S

B. The ΔG°_f is negative for roasting of sulfide ore to oxide.

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

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

Answer: D

Solution:

Solution:
The standard free energies of formation (ΔG°_f) f most of the sulfides are greater than those of CS_2 and H_2S Hence, neither carbon nor hydrogen can reduce metal sulphides to metal. The standard free energies of formation of oxides are much lower than those of SO_2. Therefore, oxidation of metal sulphides to metal oxides is thermodynamically favourable. Hence sulphide ore is roasted to the oxide before reduction.

Question25

The method of zone refining of metals is based on the principle of (2003)

Options:

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

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

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

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

Answer: D

Solution:

Solution:
Elements which are used as semiconductors such as Si, Ge, Ga, etc. are refined by this method, which is based on the difference in solubility of impurities in molten and solid state of the metal.

Question26

Cassiterite is an ore of
(1999)

Options:

A. Sb

B. Ni

C. Mn

D. Sn

Answer: D

Solution:

Solution:
Cassiterite is also called as tin stone (SnO_2), an ore of tin (Sn).

Question27

Purification of aluminium, by electrolytic refining, is known as
(1999)

Options:

A. Hoope's process

B. Baeyer's process

C. Hall's process

D. Serpeck's process

Answer: A

Solution:

Solution:
Aluminium metal obtained from Hoope's electrolytic refining process is about 99.9% pure. The cell used for this process consists of three layers. The upper layer is pure 'Al', acts as cathode, the middle layer is mixture of fluorides of Al and Ba, which acts as electrolyte. The lowest layer is impure 'Al' which acts as anode. On electrolysis pure "Al' is transferred from the bottom to the top layer, through the middle layer.

Question28

Calcium is obtained by
(1997)

Options:

A. reduction of calcium chloride with carbon

B. electrolysis of molten anhydrous calcium chloride

C. roasting of limestone

D. electrolysis of solution of calcium chloride in H_2O

Answer: B

Solution:

Calcium is obtained by the electrolysis of a fused mixture of anhydrous $CaCl_2$ and CaF_2 of a fused mixture of anhydrous $CaCl_2$ and CaF_2 in a graphite linked tank which serves as anode. The cathode is a hollow movable iron rod which is kept cool. During electrolysis, calcium is deposited at cathode while Cl_2 is liberated at anode.
