Metallurgy

1. Type of Ores

Q 1. The impurities associated with the ore after mining are collectively called
(A) Flux (B) Slag
(C) Minerals (D) Gangue

Q 2. The most abundant element in earth's crust among the following
(A)Nitrogen (B) Oxygen
(C) Iron (D) none of these

Q 3. Which of the following metals can never occur in its free state?
(A) Au (B) Ag
(C) Cu (D) Na

Q 4. The salt which is least likely to be found in minerals is
(A) Sulphide (B) Chloride
(C) Nitrate (D) Sulphate

Q 5. The incorrect statement is
(A) Calamine & siderite are carbonate ore
(B) Argentite & Cuperite are oxide ore
(C) Zinc Blende & Iron Pyrites are sulphide
(D) Malachite & Azurite are copper ore

Q 6. Argentite is a mineral of
(A) Au (B) Pt
(C) Ag (D) Cu

Q 7. Calamine is an ore of
(A) Hg (B) Zn
(C) Cd (D) Ca

Q 8. Which of the following does not contain Mg?
(A) Magentite (B) Magnesite
(C) Asbestos (D) Carnalite

Q 9. Which of the following contain both Ca & Mg?
(A) Lime Stone (B) Dolomite
(C) Chalk (D) Feldspar

Q 10. Malachite is a mineral of
(A) Mg (B) Cu
(C) Al (D) Fe

Q 11. Zinc Blende is
(A) ZnO (B) $ZnCO_3$
(C) ZnS (D) Zn_2OCl_2

Q 12. Cinebar is an ore containing
(A) Cu_2S (B) Ag_2S
(C) ZnS (D) HgS

Q 13. Which of the following is an oxide ore?
(A) Cassiterite (B) Bauxite
(C) Cryolite (D) Haematite

Q 14. Which of the following does not contain Al?
(A) Feldspar (B) Mica
(C) Flurospar (D) Cryolite

Q 15. Which of the following does not contain Mg?
(A) Dolomite (B) Magnesite
(C) Asbestos (D) Malachite

Q 16. Sulphide ore is most common for the metals **[JEE Adv. 2013]**
(A) Ag, Au & Pb (B) Ag, Mg & Pb
(C) Ag, Cu & Sn (D) Al, Cu & Pb

2. Concentration of Ore

Q 1. Match the method of concentration of the ore in column I with the ore in column II and select the correct alternate.

	Column I		Column II
X	Magnetic Seperation	(a)	Ag_2S
Y	Froth Floation	(b)	$FeCr_2O_4$
Z	Gravity Seperation	(c)	$Al_2(SiO_3)_3$

	X	Y	Z
(A)	a	b	c
(B)	b	a	c
(C)	c	a	b
(D)	b	c	a

Q 2. Forth floatation process is used for the concentration of
(A) Oxide ores (B) Sulphide ore
(C) Chloride ore (D) Amalgams

Q 3. The reason for floating of ore particles in concentration by forth flotation process is that
(A) They are light (B) They are insoluble
(C) they are charged (D) They are hydrophobic

Q 4. Oil used in froth flotation process is
(A) Pine Oil (B) Mustured Oil
(C) Coconut Oil (D) Olive Oil

Q 5. Collectors are substances which help in attachement of an ore particle to air bubble in froth. A popular collector used industrially is
(A) Sodium ethyl xanthate

(B) Sodium xenate
(C) Sodium Pyrophosphate
(D) Sodium Nitropruside

Q 6. During initial treatment, preferential wetting of ore by oil & gangue by water takes place in
(A) Levigation (Gravity Seperation)
(B) Froth Floation
(C) Leaching
(D) Bessemerisation

Q 7. Which of the following is NOT concentrated by froth floatation process? **[CBSE PMT 2007]**
(A) Copper Pyrites (B) Galena
(C) Pyrolusite (D) Zinc Blende/sphalerite

Q 8. Leaching is employed in
(A) concentration of bauxite using 45% NaOH
(B) concentration of ZnS ore from the gangue
(C) or dressing using gravity separation principle
(D) dissolving silver ore, Ag_2S, in excess NaCN

Q 9. An ore after levigation is found to have acidic impurities. Which of the following can be used as flux during smelting operation?
(A) H_2SO_4 (B) $CaCO_3$
(C) SiO_2 (D) both $CaCO_3$ & SiO_2

Q 10. Slag is formed by the reaction between
(A) Impurities & coke (B) Impurities & ore
(C) Impurities and flux (D) Flux & coke

Q 11. Which one of the following is NOT a basic flux?
(A) FeO (B) CaO
(C) SiO_2 (D) MgO

Q 12. The process of converting hydrated Alumina into anhydrous Alumina is called
(A) Roasting (B) Smelting
(C) Dressing (D) Calcination

Q 13. Calcination in the process of heating the ore in
(A) Inert Gas (B) presence of air
(C) absence of air (D) presence of CaO & MgO

Q 14. Roasting is carried out to
1. Convert sulphide to oxide and sulphate
2. remove water of hydration
3. melt the ore
4. remove arsenic and sulphur impurities
Of these statements
(A) 1, 2 & 3 are correct (B) 1 & 4 are correct
(C) 1, 2 & 4 are correct (D) 2, 3 & 4 are correct

Q 15. Roasting is carried out to
(A) Convert sulphide to oxide and sulphate
(B) Remove water of hydration
(C) melt the ore
(D) remove Arsenic and sulphur impurities

Q 16. The difference between Roasting & Calcination are
(A) Roasting is highly endothermic while Calcination is not
(B) Partial fusion occurs in Calcination but not in Roasting
(C) Calcination is preformed in limited amount of air but Roasting employs excess of air
(D) Combustion reaction occur in Roasting but not in Calcinations

Q 17. From the following, choose a pair of ores both of which are concentrated by heating the ore below its fusion temperature in the absence of air.
(A) limonite, bauxite (B) bauxite, cassiterite
(C) cassiterite, limonite (D) galena, zinc blende

Q 18. Roasting of Sulphides gives gas Z as a byproduct. This is a colourless gas with chocking smell of Brunt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aquesous solution is acidic and acts as reducing agent and tis acid has never been isolated. The gas X is **[NEET 2013]**
(A) H_2S (B) SO_2
(C) CO_2 (D) SO_3

3. Roasting, Smelting, Refining of Metals

Q 1. The Metallurgical process in which metal is obtained in a fused state is called
(A) Smelting (B) Roasting
(C) Calcination (D) Froth Floatation

Q 2. The Purpose of smelting an ore is to
(A) Reduce it (B) separate volatile impurities
(C) oxidize it (D) Obtain an alloy

Q 3. Smelting is generally carried out in
(A) Reverberatory furnace (B) Muffle furnace
(C) Bessemer converter (D) Blast furnace

Q 4. In metallurgy, flux is a substance used to convert
(A) infusible impurities to fusible material

(B) soluble impurities to insoluble impurities
(C) fusible impurities to infusible impurities
(D) mineral into silicate

Q 5. The use of netural flux is done to
(A) decrease the melting point of ore
(B) Increase the conductivity of electrolyte
(C) Act as solvent
(D) Increase Melting point of ore

Q 6. Specific Gravity of slag should be
(A) Always higher than Molten Metal
(B) Always less than Molten Metal
(C) Same as Molten Metal
(D) None of these

Q 7. Van arkel method of purification of metals involves converting the metal to a
(A) volatile stable compound
(B) volatile unstable compound
(C) non- volatile stable compound
(D) non of the above

Q 8. In electro- refining of metals, the pure metal is made the anode and a strip of pure metal the cathode during the electrolysis of an aqueous solution of a complex of a complex metal salt. This method cannot be used for refining of
(A) Silver (B) Copper
(C) Aluminium (D) Zinc

Q 9. Metals like Sn & Pb are refined by the method of
(A) Distillation (B) Oxidation
(C) Liquation (D) Poling

Q 10. The process of refining of metals which is based on the difference in fusibility of the metal and the impurities is known as
(A) distillation (B) cupellation
(C) liquation (D) poling

Q 11. Purification of semiconductor materials like Si and Ge is usually accomplished by
(A) distillation (B) electrolytic refining
(C) Zone refining (D) liquation

Q 12. The method of purification of metal employing the technique of fractional crystallisation is
(A) Cupellation (B) Zone refining
(C) Van Arkel method (D) oxidative refining

Q 13. The Zone refining Process of Metals is based on the principle of **[AIIMS 2016]**
(A) excess Noble Character of the liquid metal than that of impurity
(B) Lower melting point of the impurity than that of pure metal
(C) Greater solubility of impure metal than that of impurity
(D) Greater solubility of the impurities in the molten state than in the solid state of metals

Q 14. In Zone refining method, molten state contains **[AIIMS 2009]**
(A) impurities
(B) purified metal state
(C) more impurity than the original metal
(D) move to either side

Q 15. Zone refining is based on the principle that **[NCERT Examplar]**
(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

Q 16. Van Arkel method is employed in purification of
(A) Silicon (B) Zirconium
(C) Zinc (D) silver

Q 17. **Assertion (A)** :Nickel can be produced by Mond's method
Reason (R) :$Ni(CO)_4$ is a volatile compound which decomposes at 460 K to give pure Ni **[NCERT Examplar]**
(A) Both A & R are true and R is the correct explanation of A
(B) Both A & R are true but R is not the correct explanation of A
(C) A is true but R is False
(D) Both A and R are false

Q 18. In the extraction of nickel by Mond process, the metal is obtained by
(A) electrochemical reduction
(B) thermal decomposition
(C) chemical reduction by Al
(D) reduction by carbon

4. Refining of Metals, Pyrometallurgy, Electrometallurgy, Hydrometallurgy

Q 1. Anode mud in the electrolyte refining of silver contains
(A) Zn, Cu, Ag, Au (B) An, Ag, Au
(C) Cu, Ag, Au (D) Au

Q 2. When Cu is purified by electrorefining process, Noble Metals like Ag & Au are found as
(A) Cathode Mud (B) Electrolyte solution
(C) Anode Mud
(D) Over cathode & Anode

Q 3. Match the process listed in column I to the reactions listed in column II

	Column I		Column II
(A)	Mond's Process	(P)	$Cr_2O_3 + 2Al \xrightarrow{\Delta} 2Cr + Al_2O_3$
(B)	Van Arkel Process	(Q)	$TiCl_4 + 2Mg \xrightarrow{\Delta} Ti + 2MgCl_2$
(C)	Thermite Process	(R)	$Ni(CO)_4 \xrightarrow{\Delta} Ni + 4CO$
(D)	Kroll's Process	(S)	$ZrI_4 \xrightarrow{\Delta} Zr + 2I_2$

Q 4. In the extraction of Nickel by Mond's method, the metal is obtained by
(A) Electrochemical reduction
(B) Thermal Decomposition
(C) Chemical Reduction by Al
(D) Reduction by Carbon

Q 5. Formation of $Ni(CO)_4$ and subsequent its decomposition into Ni & CO makes the basis of Mond's Process

$$Ni + 4CO \xrightarrow{T_1} Ni(CO)_4 \xrightarrow{T_2} Ni + 4CO$$

T_1 & T_2 are
(A) 100 °C, 500 °C (B) 50 °C, 100 °C
(C) 50 °C, 220 °C (D) 230 °C, 50 °C

Q 6. Ag obtained from argentiferous lead containing lead impurity is purified by **[AIEEE 2008]**
(A) Distillation (B) Froth Floation
(C) Cupellation (D) Treatment with KCN

Q 7. What is meant by the term chromatography? **[NCERT]**

Q 8. What criteria is followed for the selection of the stationary phase in chromatography? **[NCERT]**

Q 9. In thermite process, the reducing agent is
(A) C (B) Zn
(C) Na (D) Al

Q 10. Among the following group of oxides, the group that cannot be reduced by carbon to give the respective metals is
(A) Cu_2O, K_2O (B) Fe_2O_3
(C) CaO, K_2O (D) PbO, Fe_3O_4

Q 11. Reduction of a metal oxide by excess carbon at high temperature is a method for the commercial preparation of same metals. This method can be successfully applied in the case of
(A) BeO and Al_2O_3 (B) ZnO and Fe_2O_3
(C) CaO and Cr_2O_3 (D) BaO and U_3O_8

Q 12. In the cyanide process for extraction gold and silver form ores, the cyanide solution acts as a
(A) reducing agent to reduce the gold and silver compounds present in the ores into metals
(B) Leaching agent to bring the gold and silver into solution as cyanide complexes and thus separate these metals from the ores
(C) leaching agent to dissolve all the other constituents of the ores leaving the gold and silver as metals.
(D) leaching agent to bring the ores into solution.

Q 13. Chromium is obtained by reducing purified Chromite ore with
(A) Red Hot Coke (B) Gaseous Hydrogen
(C) Aluminum Powder (D) Carbon Monooxide

Q 14. Self Reduction is carried out for
(A) Hg, Pb (B) Pb, Al
(C) Al, Ag (D) Hg, Al

Q 15. Polling process is used to remove
(A) Cu_2O from Cu (B) Al_2O_3 from Al
(C) Fe_2O_3 from Fe (D) in all of above

Q 16. There are several reducing agents used to obtain metals from their ores. Carbon is one of the most common reducing agents. It is used in the extraction of
(A) Cu (B) Ag
(C) Cr (D) Pb, Zn, Fe

5. Electrometallurgy, Hydrometallurgy

Q 1. Of the following, the metals that cannot be obtained by electrolysis of the aqueous solution of their salts are
(A) Ag (B) Mg
(C) Cu (D) Al

Q 2. Native Ag Metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of
(A) Nitrogen (B) Oxygen
(C) CO (D) Argon

Q 3. In the Cyanide process of extraction of Ag from Argentite ore, the oxidising and reducing agent respectively are
(A) O_2 & CO_2 (B) O_2 & Zn dust
(C) HNO_3 & CO (D) HNO_3 & Zn dust

Q 4. In the reactions

$$Ag_2S + NaCN \longrightarrow A$$

$$A + Zn \longrightarrow B$$

B is a metal. Hence A & B are
(A) $Na_2[Zn(CN)_4]$, Zn (B) $Na[Zn(CN)_2]$, Ag
(C) $Na_2[Ag(CN)_3]$, Ag (D) $Na_3[Ag(CN)_4]$, Ag

Q 5. In the reaction,

$$4M + 8CN^- + 2H_2O + O_2 \rightarrow 4[M(CN)_2]^- + 4OH^-$$

Identify the Metal (M) **[AIIMS 2017, 12]**
(A) Au (B) Fe
(C) Zn (D) Cu

Q 6. Extraction of Au & Ag involves leaching with CN^- ion. Silver is later recovered by **[NEET 2017]**
(A) Liquation (B) Distillation
(C) Zone Refining (D) Displacement with Zn

Q 7. **Assertion (A)** : Hydrometallurgy involves dissolving the ore in a suitable reagent followed by precipitation by a more electropositive metal.
Reason (R) : Copper is extracted by Hydrometallurgy. **[NCERT Examplar]**
(A) Both A & R are true and R is the correct explanation of A
(B) Both A & R are true but R is not the correct explanation of A
(C) A is true but R is False
(D) Both A and R are false

Q 8. Which of the following metals is leached by cynide process?
(A) Ag, Au (B) Na, Mg
(C) Al, K (D) Mg, Ca

Q 9. Ag & Au are extracted from their ore by
(A) Reduction with Al (B) Smelting
(C) Roasting (D) Hydrometallurgy

Q 10. Which of the following is obtained by Electrolytic reduction process?
(A) Cu (B) Na
(C) Mg (D) Ag

Q 11. Match the items listed in column I with the items of Column II and Assign the correct code. **[NEET 2016, II]**

	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

Codes

	A	B	C	D		A	B	C	D
(A)	2	3	1	5	(B)	1	2	3	4
(C)	3	4	5	1	(D)	4	2	3	1

Q 12. Electrolysis Method is mainly used for the extraction of
(A) Cu (B) Fe (C) Al (D) Na

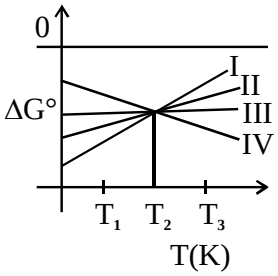
Q 13. Calcium is obtained by **[CBSE PMT 1997]**
(A) Roasting of lime stone
(B) Electrolysis of solution of calcium chloride in H_2O
(C) Electrolysis of Molten anhydrous calcium chloride
(D) Reduction of calcium chloride with carbon

Q 14. In the extraction of chlorine by electrolysis of brine (Aqs NaCl Solution) **[NCERT Examplar]**
(A) Oxidation of Cl^- ion to chlorine gas occur
(B) Reduction of Cl^- ion to chlorine gas occur
(C) For overall reaction ΔG^o has negative value
(D) A displacement reaction takes place

Q 15. Metal which do not form amalgam is/are
(A) Fe (B) Zn (C) Ni (D) Au

6. Ellingham's Diagram

Based on the given Graph between ΔG^o vs T(K) answer the following questions from 1 to 5.



$P: C(s) + O_2(g) \rightarrow CO_2(g)$

$Q: C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$

$R: CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

$S: Fe(s) + \frac{1}{2}O_2(g) \rightarrow FeO(s)$

Q 1. Correct Match of the reactions with their plot is

	I	II	III	IV		I	II	III	IV
(A)	P	Q	R	S	(C)	R	S	P	Q
(B)	Q	P	S	R	(D)	S	R	Q	P

Q 2. If $T_1 > T_2$, then Strongest Reductant for FeO(s) is
(A) C(s) in P (B) C(s) in Q
(C) CO(g) in R (D) None

Q 3. If $T_1 < T_2$, then Strongest Reductant for FeO(s) is
(A) C(s) in P (B) C(s) in Q
(C) CO(g) in R (D) All

Q 4. At what approximate temperature Iron & Carbon has same affinity for oxygen?
(A) T_2 (B) T_3
(C) T_1 (D) Can Not say

Q 5. $\Delta G^o vs T$ plot in Ellingham's diagram slopes downward for which of the following reactions **[AIIMS 2014]**

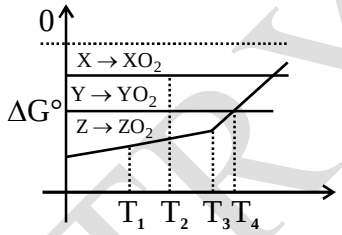
(A) $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$

(B) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

(C) $2Ag(s) + \frac{1}{2}O_2(g) \rightarrow Ag_2O(s)$

(D) $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$

Based on the given Graph between ΔG^o vs T(K) answer the following questions from 6 to 8.

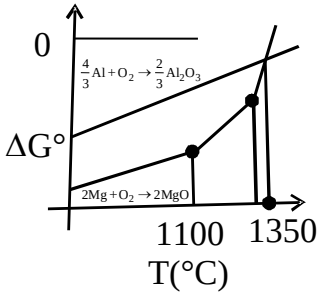


Q 6. T_1 & T_3 represents
(A) M.P. & B.P. of Z (B) M.P. & B.P. of ZO_2
(C) M.P. of Z & ZO_2 (D) B.P. of Z & ZO_2

Q 7. At T = T_2, which of the following reaction is most feasible?
(A) $X + YO_2 \rightarrow Y + XO_2$
(B) $X + ZO_2 \rightarrow Z + XO_2$
(C) $Z + YO_2 \rightarrow Y + ZO_2$
(D) $Z + XO_2 \rightarrow X + ZO_2$

Q 8. At T = T_4,
ΔG for the reaction, $Y + ZO_2 \rightarrow Z + YO_2$ is
(A) $\Delta G > 0$ (B) $\Delta G < 0$
(C) $\Delta G = 0$ (D) Can not Say

Based on the given Graph between ΔG^o vs T(°C) answer the following questions from 9 to 11.

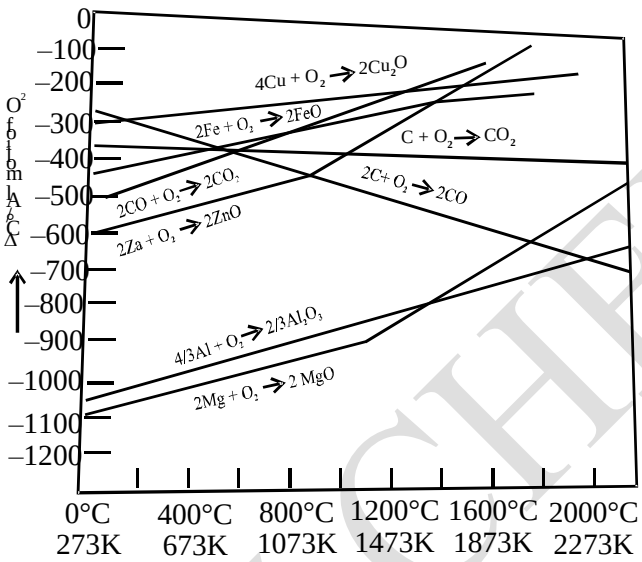


Q 9. Mg(s) can reduce Al_2O_3(s) at T_1 & Al (s) can reduce MgO(s) at T_2. Then T_1 & T_2 may be
(A) 1200 °C, 1400 °C (B) 1200 °C, 1200 °C
(C) 1350 °C, 1200 °C (D) 1200 °C, 1350 °C

Q 10. MgO (s) can most easily be reduced by Al(s) if Physical state of Mg is
(A) Solid (B) Liquid
(C) Gas (D) Doesn't matter

Q 11. ΔG^o for $Ag(s) \rightarrow Ag_2O(s)$ & $Hg(s) \rightarrow HgO(s)$ is positive after some temperature. It means that
(A) One Metal oxide can reduced by 2nd Metal
(B) Both Metal can reduce Al_2O_3(s) at High T
(C) $\Delta H^o > 0$ initally for both reactions
(D) Both Metal oxides are thermally unstable

Based on the given Graph between ΔG^o vs T(°C) answer the following questions from 12 to 19.



Q 12. Cuprous oxide is reduced to metallic Cu by heating with Coke

$$Cu_2O(s) + C(s) \rightarrow 2Cu(s) + CO(g)$$

Approx. temperature of the reaction must be
(A) > 800 °C (B) > 200 °C
(C) > 900 °C (D) > 1000 °C

Q 13. The reduction of FeO, Fe_3O_4 and Fe_2O_3 by CO can be occurred at
(A) Relatively Higher temperature (T > 800 °C)
(B) Relatively Lower Temperature (T < 800 °C)
(C) Approximately T = 800 °C
(D) Very low temperature (T $\approx$ 0 °C)

Q 14. Select True (T) & False (F) among the following statements.
I. Al_2O_3, ZnO, FeO, Cu_2O may be reduced by Mg
II. Zn reduces FeO & Cu_2O more readily than Al reduces FeO & Cu_2O
III. Al_2O_3, ZnO & MgO can be reduced by Fe
IV. Zn reduces Cu_2O more readily than Fe reduces Cu_2O
(A) TTTT (B) FTTF
(C) FFFF (D) TFFT

Q 15. Correct order of tendency of metals to get oxidized by oxygen is
(A) Hg > Cu > Fe > Mg (B) Hg > Mg > Fe > Cu
(C) Mg > Fe > Cu > Hg (D) Cu > Fe > Mg > Hg

Q 16. C(s) can't be used in reduction of Al_2O_3 because
(A) It is expensive
(B) the enthalpy of formation of CO_2 is more than that of Al_2O_3
(C) Pure Carbon is not easily available
(D) the enthalpy of formation of Al_2O_3 is more than that of CO_2

Q 17. Although Thermodynamically feasible, in practice, Mg metal is not used for reduction of Alumina in metallurgy of Al. Why? **[NCERT Example]**

Q 18. Is it true that under certain conditions, Mg can reduce Al_2O_3 and Al can reduce MgO? What are those conditions? **[NCERT Example]**

Q 19. Why is the reduction of a metal oxide easier if the metal formed is in liquid state at the temperature of reduction? **[NCERT Example]**

Q 20. The value of $\Delta_f G^o$ for the formation of Cr_2O_3 is – 540 KJ/mol and that of Al_2O_3 is –827 KJ/mol. Is the reduction of Cr_2O_3 possible with Al. **[NCERT]**

Q 21. Which of the following statements about the advantage of raosting of sulphide ores offer an exception and is concentrated by chemical leaching? **[CBSE PMT 2007]**
(A) Carbon and hydrogen are suitable reducing agents for metal sulphide
(B) the $\Delta_f G^o$ of the sulphide is greater than those of CS_2 and H_2S
(C) the $\Delta_f G^o$ is negative for roasting of sulphide ore to oxide

(D) Roasting of the sulphide to the oxide is thermodynamically feasible

Q 22. Which of the following factors is of NO significance for roasting sulphide ores to the oxides and not subjecting the sulphide ore to the carbon reduction directly? **[AIEEE 2008]**
(A) Metal Sulphides are thermodynamically more stable than CS_2
(B) CO_2 is thermodynamically more stable than CS_2
(C) Metal sulphides are less stable than Metal oxides
(D) CO_2 is more volatile than CS_2

7. Extraction of Cu, Fe

Q 1. How is leaching carried out in the case of low grade Cu ore? **[NCERT]**

Q 2. Formation of Metallic Cu from sulphide ore in the commercial thermo – metallurgical process essentially involves which of the following reaction?

(A) $Cu_2S(s)+\frac{3}{2}O_2(g)\rightarrow Cu_2O(s)+SO_2(g)$
$CuO(s)+C(s)\rightarrow Cu(s)+CO(g)$

(B) $Cu_2S(s)+\frac{3}{2}O_2(g)\rightarrow Cu_2O(s)+SO_2(g)$
$2Cu_2O(s)+Cu_2S(s)\rightarrow 6Cu(s)+SO_2(g)$

(C) $Cu_2S(s)+2O_2(g)\rightarrow 2CuSO_4$
$CuSO_4+Cu_2S(s)\rightarrow 3Cu(s)+2SO_2(g)$

(D) $Cu_2S(s)+\frac{3}{2}O_2(g)\rightarrow 2Cu_2O(s)+SO_2(g)$
$Cu_2O+CO(g)\rightarrow 2Cu(s)+CO_2(g)$

Q 3. Which of the following reaction does not occur in Bessemer's convertor?
(A) $Cu_2S+5O_2\rightarrow 2CuSO_4+2CuO$
(B) $2Cu_2S+3O_2\rightarrow 2Cu_2O+2SO_2$
(C) $2CuFeS_2+O_2\rightarrow Cu_2S+FeS+SO_2$
(D) $FeO+SiO_2\rightarrow 2FeSiO_3$

Q 4. When Copper ore is mixed with Silica, in a reverberatory furnace copper matte is produced. The Copper matte contains **[NCERT Examplar]**
(A) Sulphide of Copper (II) & Iron (II)
(B) Sulphide of Copper (II) & Iron (III)
(C) Sulphide of Copper (I) & Iron (II)
(D) Sulphide of Copper (I) & Iron (III)

Q 5. Blister Cu is refined by stirring molten impure metal with green logs of wood because such a wood liberates hydrocarbon gases like CH4. The process X is called …….. and the metal contains impurities Y is ……..
(A) X = Cupellation, Y = CuO_2
(B) X = Polling, Y = Cu_2O
(C) X = Polling, Y = CuO
(D) X = Cupellation, Y = CuO

Q 6. Blister Cu is about
(A) 60 % Cu (B) 90 % Cu
(C) 98 % Cu (D) 100 % Cu

Q 7. The slag formation occur in metallurgy of Cu is
(A) $FeSiO_3$ (B) $CuSiO_3$
(C) $CaSiO_3$ (D) None of these

Q 8. Of the following reduction processes, correct processes are
(A) $Fe_2O_3+C\rightarrow Fe$ (B) $ZnO+C\rightarrow Zn$
(C) $Ca_3(PO_4)_2+C\rightarrow P$ (D) $PbO+C\rightarrow Pb$

Q 9. Extraction of Zn form Zinc Blende is achieved by **[IIT JEE 2007]**
(A) Electrolytic reduction
(B) Roasting followed by reduction with Carbon
(C) Roasting followed by reduction with another Metal
(D) Roasting followed by self reduction

Q 10. In extractive Metallurgy of Zinc, Partial fusion of ZnO with Coke is called …… and reduction of the ore to the molten metal is called…… **[IIT JEE 1988]**
[smelting, calcining, roasting, sintering]

Q 11. Iron produced from Blast Furnace is
(A) wrought Iron (B) Cast Iron
(C) Pig Iron (D) Steel

Q 12. During extraction of Fe, slag produced is
(A) CO (B) $FeSiO_3$
(C) $MgSiO_3$ (D) $CaSiO_3$

Q 13. The chemical processes in the production of steel from Heamatite ore involve
(A) Reduction
(B) Oxidation
(C) Reduction followed by Oxidation
(D) Oxidation followed by Reduction

Q 14. The charge added to the Blast furnace in extraction of Fe is
(A) $Fe_2O_3 + C + SiO_2$ (B) $Fe_2O_3 + C + CaCO_3$
(C) $Fe_2O_3 + CaCO_3 + SiO_2$ (D) $CaCO_3 + C + SiO_2$

Q 15. The lower Zone of Blast Furnace is called
(A) Zone of combustion (B) Zone of Fusion
(C) Zone of reduction (D) Zone of absorption

Q 16. Reduction of Fe_2O_3 in Blast furnace occur at
(A) Uppermost region (B) Lowermost region
(C) Between the furnace (D) None of these

Q 17. The most pure form of Fe is
(A) Pig Iron (B) Cast Iron
(C) Wrought Iron (D) Steel

8. Extraction of Al, Zn, General Extraction Method

Q 1. In the extraction of Al
Process X: Applied for red Bauxite to remove Iron Oxide (chief Impurity)
Process Y: (Serpeck's Process) : Applied for white bauxite to remove Z (chief impurty) then process X and impurity Z are
(A) X = Hall & Heroult's process & Z = SiO_2
(B) X = Baeyer's process & Z = SiO_2
(C) X = Serpeck's process & Z = FeO
(D) X = Baeyer's process & Z = FeO

Q 2. In the context of the Hall – Heroult process for the extraction of Al, which of the following statements is false? **[JEE Main 2015]**
(A) Al^{3+} is reduced to Al at cathode
(B) Na_3AlF_6 serves as electrolyte
(C) CO & 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 increases the conductivity

Q 3. The chemical treatment of the ore for concentration is done in the case of
(A) Al (B) Ag (C) Cu (D) Au

Q 4. Amphoteric Nature of Al is employed in which of the following process for extraction of Al?
(A) Baeyer's process (B) Hall's process
(C) Serpeck's process (D) Dow's process

Q 5. In extraction of Al, the function of cryolite is
(A) Lower the melting point of Alumina
(B) Increase the melting point of Alumina
(C) Remove Impurities from Alumina
(D) Minimise the anodic effect

Q 6. The electrolyte in Al extraction is covered with C dust to
(A) Avoid Heat Loss
(B) Convert in Aluminum Carbide
(C) to convert O_2 into CO_2
(D) None of these

Q 7. Which electrolyte undergo electrolysis in Al extraction?
(A) Al_2O_3 (B) Na_3AlF_6
(C) CaF_2 (D) NaF

Q 8. **Assertion (A)** : Al_2O_3 is converted into Al by reduction with Carbon.
Reason (R) : Carbon (Graphite) has greater affinity for Oxygen than Al **[AIIMS 2010]**
(A) Both A & R are true and R is the correct explanation of A
(B) Both A & R are true but R is not the correct explanation of A
(C) A is true but R is False
(D) Both A and R are false

Q 9. In metallurgy of Al **[NCERT Examplar]**
(A) Al^{3+} is oxidized to Al
(B) Graphite anode is oxidized to carbon monoxide and carbon dioxide
(C) Oxidation state of oxygen changes in the reaction at anode
(D) Oxidation state o oxygen changes in the overall reaction involved in the process

Q 10. Which method is used to purify Al
(A) Baeyer's process (B) Serpeck's process
(C) Hoop's process (D) Hall's process

Q 11. Which of the following combinations represents the correct matching of metals with the most commonly employed ores for their extraction? **[AIIMS 2002]**

	Fe	Zn	Cu	Al
(A)	Haematite	Sphalerite	Copper pyrites	Bauxite
(B)	Iron Pyrites	Zincite	Cuperite	Clay
(C)	Siderite	Calamite	Malachite	Aluminium Phosphate
(D)	Siderite	Magnetite	Copper Glance	Bauxite

Q 12. Extraction of Metal from the ore of casseiterite 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

Q 13. Pb and Sn are extracted from their chief ore by
(A) Carbon reduction & self reduction
(B) Self reduction & Carbon reduction
(C) Electrolysis & self reduction
(D) Self reduction & Electrolysis

Q 14. Which of the following process is used in extractive metallurgy of Mg?
(A) Fused Salt electrolysis
(B) Self reduction
(C) Aqueous solution electrolysis
(D) Thermite reduction

Q 15. Which one of the following metal can be extracted by aluminothermite process?
(A) Mangnese (B) Iron
(C) Chromium (D) Magnesium

Q 16. For which of the following metal, carbon reduction process can not be used?
(A) Lead (B) Manganese
(C) Tungston (D) Iron

Answer Key

1. Type of Ores

(1). D	(2). B	(3). D
(4). C	(5). B	(6). C
(7). B	(8). A	(9). B
(10). B	(11). C	(12). D
(13). C	(14). C	(15). D
(16). A		

2. Concentration of Ore

(1). B	(2). B	(3). D
(4). A	(5). A	(6). B
(7). C	(8). A	(9). B
(10). C	(11). C	(12). D
(13). C	(14). B	(15). A, B, D
(16). C, D	(17). A	(18). B

3. Roasting, Smelting, Refining of Metals

(1). A	(2). A	(3). A
(4). A	(5). A, B, C	(6). B
(7). A	(8). C	(9). C
(10). C	(11). C	(12). B
(13). D	(14). C	(15). B
(16). B	(17). A	(18). B

4. Pyrometallurgy, Electrometallurgy, Hydrometallurgy

(1). D (2). C
(3). A – R, B – S, C – P, D – Q
(4). B (5). C (6).C
(7). Chromatography involves separation of a mixture which are close in chemical properties &

very low in concentration by different extent of adsorption in adsorbent.
(8). The stationary phase is porous solid (Glass, Silica, Alumina) that is packed into glass or metal tube which adsorbs the component of mobile phase to different phase.

(9). D	(10). C	(11). B
(12). C	(13). C	(14). A
(15). A	(18). A, D	

5. Electrometallurgy, Hydrometallurgy

(1). B, D	(2). B	(3). B
(4). B	(5). A	(6). D
(7). B	(8). A	(9). D
(10). B, C	(11). D	(12). C, D
(13). C	(14). C	(15). A, C

6. Ellingham's Diagram

(1). B	(2). B	(3). C
(4). A	(5). A	(6). A
(7). D	(8). C	(9). A
(10). C	(11). D	(12). B
(13). B	(14). D	(15). C
(16). D		

(17). At Temp. below the intersection of Al_2O_3 & MgO in Ellingham diagram, Mg can reduce Al_2O_3 but The process becomes too slow & so become uneconomical
(18). At Temp. below the intersection of Al_2O_3 & MgO in Ellingham diagram, Mg can reduce Al_2O_3 & at Temp. above the intersection Al can reduce MgO
(19). The entropy is higher for liquid metal and hence it makes ΔG^o more negative and hence process becomes more spontaneous.
(20). ΔG^o = –287 KJ/mol, Al can reduce Cr_2O_3

(21). A	(22). C

7. Extraction of Cu, Fe

(1). For low grade Cu ore, Leaching is carried out with acid or bacteria in presence of air. Copper goes into Cu^{2+} ions

$$Cu(s) + 2H^+ + \frac{1}{2}O_2 \longrightarrow Cu^{2+} + 2H_2O$$

and then reacted with Scrap Fe or H_2 to get metallic Cu.

$$Cu^{2+} + H_2 \longrightarrow Cu + 2H^+$$

(2). B	(3). C	
(4). C	(5). B	(6). C
(7). A	(8). A	(9). B
(10). Sintering, Smelting		(11). C
(12). D	(13). D	(14). B
(15). A	(16). A	(17). C

8. Extraction of Al, Zn, General Extraction Method

(1). B	(2). B	(3). A, B, D
(4). A, C	(5). A	(6). A
(7). B	(8). D	(9). B
(10). C	(11). A	(12). D
(13). B	(14). A	(15). A, B, C
(16). B, C		