INORGANIC CHEMISTRY

Target : JEE (MAIN + ADVANCE) 2020

General principles and processes of isolation of elements (Metallurgy)

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EXERCISE-1

GENERAL PRINCIPLES INVOLVED IN METALLURGY / CONCENTRATION / ORES AND THEIR CONCENTRATION

Q.1   Metallurgy is the process of
(A) Concentration of ore   (B) Roasting of ore
(C) Extraction of metal from the ore   (D) Adding carbon to the ore in blast furnace

Q.2   Which of the following metal is not found in free state
(A) Zn   (B) Au   (C) Ag   (D) Hg

Q.3   All ores are minerals, while all minerals are not ores because
(A) The metal cannot be extracted economically from all the minerals
(B) Minerals are complex compounds
(C) The minerals are botained from mines
(D) All of these are correct

Q.4   Which one of the followng does not occur as sulphide ore
(A) Zn   (B) Cr   (C) Ag   (D) Fe

Q.5   Electrometallurgical process is used to extract
(A) Fe   (B) Pb   (C) Na   (D) Ag

Q.6   Which of the following metal is extracted by carbon reduction process
(A) Cu   (B) Ca   (C) Hg   (D) Zn

Q.7   Which metal is extracted by electrolytic reduction method
(A) Cu   (B) Ca   (C) Fe   (D) Ag

Q.8   Thermite process is used to extracted metals
(A) When their oxides can be reduced by carbon
(B) When their carbonates do not yield oxides by thermal decomposition
(C) When their sulphides cannot be converted into oxides by roasting
(D) When their oxides are highly stable

Q.9   'Lapis-Lazuli' is a blue coloured precious stone. It is mineral of the class
(A) Sodium-alumino silicate   (B) Zinc cobaltate
(C) Basic copper carbonate   (D) Prussian blue

Q.10   The lustre of a metal is due to
(A) its high density   (B) polished surface
(C) its chemical inertness   (D) presence of free electrons

Q.11   Which of the following processes is used in exctractive metaullurgy of magnesium?
(A) Fused salt electrolysis   (B) Self reduction
(C) Aqueous solution electrolysis   (D) Thermite reduction

Q.12 Which metal is commercially extracted by hydrometallurgical process involving complexation?
(A) Mg (B) Au (C) Cu (D) Zn

Q.13 Which of the following metal is obtained by Self-Reduction process?
(A) Copper (B) Iron (C) Silver (D) Magnesium

Q.14 Cyanide process is used for the concentration of
(A) Au (B) Ag (C) Al (D) Both A & B

Q.15 Froth floatation process for the concentration of ores is an illustration of physical phenomenon of
(A) Adsorption (B) Absorption (C) Coagulation (D) Sedimentation

Q.16 The method of concentration of the ore that makes use of difference in density between ore and impurities is called
(A) Levigation (B) Leaching
(C) Magnetic separation (D) Liquation

Q.17 During concentration of Tin stone separation of sulframates of Fe^{II} and Mn^{II} is based on the fact
(A) SnO_2 is paramagnetic (B) SnO_2 is diamagnetic
(C) $FeWO_4$ and $MnWO_4$ are paramagnetic (D) Both B and C

Q.18 Leaching of Ag_2S by NaCN solution is carried out in the presence of air it, because :
(A) $[Ag(CN)_2]^-$ complex is formed in a reversible reaction
(B) oxidation of formed Na_2S into Na_2SO_4 and sulphur
(C) both (A) and (B)
(D) none of the above

Q.19 In froth-floatation process, pine oil functions as
(A) activator (B) frother (C) collector (D) agitator

Q.20 Collector are the substance which combine with sulphide ore and make them water repellant, which of the following substance can act as collector
(A) sodium ethyl xanthate (B) sodium xenate
(C) sodium pyrophosphate (D) adsorption

Q.21 Preferential wetting of ore by oil and gangue by water takes place during
(A) Levigation (B) Froth floatation (C) Leaching (D) Bessemerisation

Q.22 Concentration of sulphide ores can be carried out by
(A) Liquation (B) Leaching
(C) Froth-floatation process (D) Both B & C

Q.23 Froth floatation process for concentration of ores is an illustration of the practical application of:
(A) Adsorption (B) Absorption (C) Coagulation (D) Sedimentation

Q.24 The most abundant element in the earth crust is
(A) Aluminium (B) Oxygen (C) Silicon (D) Iron

Q.25   Titanium containing ore found in the earth crust is
(A) Bauxite   (B) Dolomite   (C) Chalcopyrites   (D) Ilmenite

Q.26   Silicon is main constituent of
(A) Alloys   (B) Rocks   (C) Seawater   (D) Plants

Q.27   A mineral is called ore if
(A) Metal present in mineral is precious   (B) Metal present in mineral is in low content
(C) Metal present in mineral is in rich content   (D) Metal cannot be extracted from it

Q.28   Which of the following does not contain Mg
(A) Magnetite   (B) Asbestos   (C) Magnesite   (D) Carnallite

Q.29   Composition of azurite mineral is
(A) $CuCO_3CuO$
(B) $Cu(HCO_3)_2.Cu(OH)_2$
(C) $2CuCO_3.Cu(OH)_2$
(D) $CuCO_3.2Cu(OH)_2$

Q.30   The salt which is least likely to be found in minerals is
(A) Halides   (B) Carbonate   (C) Sulphide   (D) Nitrate

Q.31   Metal which can be extracted from all the three dolomite, magnesite and carnallite is
(A) Na   (B) K   (C) Mg   (D) Ca

Q.32   Cinnabar is an ore of
(A) Hg   (B) Cu   (C) Pb   (D) Zn

Q.33   An example of halide ore is
(A) Galena   (B) Bauxite   (C) Cinnabar   (D) Cryolite

Q.34   Which of the following is not an ore
(A) Bauxite   (B) Malachite   (C) Zinc blende   (D) Pig iron

Q.35   Which of the following ore is used for industrial extraction of aluminium
(A) Corundum   (B) Kaolin   (C) Cryolite   (D) Bauxite

Q.36   Siderite is an ore of
(A) Cu   (B) Al   (C) Ag   (D) Fe

Q.37   Corundum is
(A) $Al_2O_3.H_2O$ (B) Al_2O_3 (C) $Al_2O_3.2H_2O$ (D) $Al_2O_3.2SiO_2.2H_2O$

Q.38   Formula of magnetite is
(A) Fe_2O_3 (B) $Fe_2O_3.3H_2O$ (C) $FeCO_3$ (D) Fe_3O_4

Q.39   Which of the following ores does not represent the ore of iron
(A) Haematite   (B) Magnetite   (C) Cassiterite   (D) Limonite

Q.40 Which of the following ore is called malachite
(A) $CuFeS_2$
(B) $CuCO_3.Cu(OH)_2$
(C) Cu_2S
(D) $2CuCO_3.Cu(OH)_2$

Q.41 Calamine is
(A) $ZnSO_4$
(B) ZnO
(C) ZnS
(D) $ZnCO_3$

Q.42 Which of the following statement is incorrect·
(A) Silver glance mainly contains silver sulphide
(B) Gold is found in native state
(C) Tin stone is oxide ore
(D) Chalcocite: $CuFeS_2$

Q.43 Which ore contains both iron and copper?
(A) Cuprite
(B) Chalcocite
(C) Chalcopyrite
(D) Malachite

Q.44 Commercially important ore of lead from which it is extracted is
(A) Anglesite
(B) Cerussite
(C) Galena
(D) Siderite

Q.45 Cassiterite is an ore of
(A) Mn
(B) Ni
(C) Sb
(D) Sn

Q.46 Among the following statements, the incorrect one is
(A) Calamine and siderite are carbonates
(B) Argentite and cuprite are oxides
(C) Zinc blende and pyrites are sulphides
(D) Hornsilver is halide ore

Q.47 Which of the following sulphide ore is concentrated by leaching
(A) Argentite
(B) Galena
(C) Copper pyrite
(D) Sphalerite

Q.48 Froth floatation process is used for the concentration of
(A) Oxide ores
(B) Sulphide ores
(C) Halide ores
(D) Sulphate ores

Q.49 Process used for the concentration of ore is
(A) Froth floatation
(B) Roasting
(C) Electrolysis
(D) Bessemerization

Q.50 Magnetic separation is used for the concentration of
(A) Horn silver
(B) Gypsom
(C) Chromite
(D) Magnesite

Q.51 Cassiterite is concentrated by
(A) Levigation
(B) Electromagnetic separation
(C) Froth floatation
(D) Liquation

Q.52 Bauxite ore is concentrated by
(A) Froth floatation
(B) Cyanidation
(C) Chemical leaching
(D) Calcination

Q.53 Zinc blende is concentrated by
(A) Froth floatation
(B) Magnetic separation
(C) Leaching
(D) Roasting

Q.54 Gravity separation process is primarily used for the concentration of
(A) Calamine
(B) Haematite
(C) Chalcopyrite
(D) Bauxite

Q.55   Froth floatation process is used for concentration of
(A) Chalcopyrite   (B) Bauxite   (C) Haematite   (D) Calamine

Q.56   Which one of the following beneficiation process is used for the ore, $Al_2O_3.2H_2O$
(A) Froth floatation   (B) Leaching   (C) Liquation   (D) Magnetic separation

Q.57   Naturall occuring materials from which an element can be extracted economically are called
(A) Ores   (B) Minerals   (C) gangue   (D) None of these

Q.58   Cassiterite is concentrated by
(A) Levigation   (B) Electromagnetic separation
(C) Floatation   (D) Liquefaction

Q.59   Wolframites are separated from tin stone ore by the process of
(A) Calcination   (B) Electromagnetic process
(C) Roasting   (D) Smelting

Q.60   Which of the following is not an ore?
(A) Azurite   (B) Siderite   (C) Clay   (D) Cerussite

Q.61   Select the correct match:

	Column-I (Method of conc.)		Column-II (Ores)
X	Magnetic separation	(a)	Ag_2S
Y	froth floation	(b)	$FeCr_2O_4$
Z	Leaching	(c)	$Al_2O_3.2H_2O$

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

Q.62   Incorrect statement is
(A) Casseterite, chromite and haematite can be concentrated by hydraulic washing method.
(B) In Hall's process Red Bauxite is purified by leaching,
(C) Sulphide ore is concentrated by froth floatation process.
(D) During roasting of sulphide ore both metal oxide and metal sulphate are formed.

Q.63   Which one of the following is not a method of concentration of ore?
(A) Gravity separation   (B) Froth floatation process
(C) Electromagnetic separation   (D) Bessemerization

Q.64   Leaching is commercially used in the concentration of:
(A) Haematite   (B) Argentite   (C) Galena   (D) Cinnabar

Q.65   In the froth floatation process, NaCN is added as depressant when galena is associated with impurity of ZnS, because
(A) $Pb(CN)_2$ is precipitated while ZnS remains unaffected,
(B) ZnS forms soluble complex $Na_2[Zn(CN)_4]$ while PbS combines with frother.
(C) PbS forms soluble complex $Na_2[Pb(CN)_4]$ while ZnS combines with frother.
(D) NaCN regenerates ZnS from complex $[Zn(CN)_4]^{2-}$.

Q.66   Which mineral has been named incorrectly?
(A) bauxite   : $Al_2O_3.2H_2O$ (B) Chalcocite   : Cu_2S
(C) Cryolite   : $3NaF. AlF_3$ (D) Feldspar   : $Be_3Al_2Si_6O_{18}$

Q.67   Carnallite does not contain
(A) K   (B) Ca   (C) Mg   (D) Cl

Q.68   Identify the metal M which is present in its ore as $MFeS_2$:
(A) copper   (B) tin   (C) lead   (D) zinc

Q.69   The main ore of copper is:
(A) chalcocite   (B) Chalcopyrite   (C) Azurite   (D) Cerussite

Q.70   Three most abundunt elements in the earth crust in their decreasing order of percentage.
(A) O, Si, Al   (B) Si, O, Al   (C) Al, O, Si   (D) O, Fe, Si

Q.71   An ore containing the impurity of $FeCr_2O_4$ is concentrated by
(A) magnetic-separation   (B) gravity separation
(C) froth-floatation method   (D) electrostatic method

Q.72   Formula of dolomite is :
(A) $CaMg(CO_3)_2$ (B) $MgCO_3$ (C) $CacO_3.MgCO_3$ (D) (A) & (C) both

Q.73   Incorrect statement is :
(A) calamine and siderite are carbonates   (B) argentite and cuprite are oxide
(C) zinc blende and pyrites are sulphides   (D) malachite and azurite are ores of copper

Q.74   The impurities present in a mineral are called:
(A) gangue   (B) flux   (C) pulverization   (D) nuggets

Q.75   Correct statement is:
(A) Magnetite is an ore of magnesium   (B) Pyrolusite is mixed oxide of Mn
(C) Siderite is carbonate ore of iron   (D) FeS_2 is rolled gold

Q.76   Elements found in native state are
(A) Mg & Al   (B) Cu & Fe   (C) Zn & Pb   (D) Pt & Au

Q.77   The reason, for floating of ore particles in concentration by froth floatation process is that:
(A) they are light   (B) they are insoluble
(C) they are charged   (D) they are adsorbed over air bubbles

Q.78   The formula of carnallite is :
.   (A) $LiAl(Si_2O_5)_2$ (B) $KCl.MgCl_2.6H_2O$
(C) $K_2OAl_2O_3.6SiO_2$ (D) $KCl.MgCl_2.2H_2O$

Q.79   Which of the following is not an ore of iron?
(A) Haematite   (B) Limonite   (C) Siderite   (D) Malachite

Q.80   "Fool's gold" is
(A) iron pyrites   (B) horn silver   (C) copper pyrites   (D) bronze

REDUCTION / EXTRACTION OF METALS

Q.81   Extraction of zinc from zinc blende is achieved by
(A) Electrolytic reduction
(B) Roasting followed by reduction with carbon
(C) Roasting following reduction with another metal
(D) Roasting followed by self-reduction

Q.82   Roasting is generally done in case of the following.
(A) Sulphate ores   (B) Silicate ores   (C) Sulphide ores   (D) Carbonate ores

Q.83   Electric furnaces are lined with magnesia because
(A) it is not affected by acids   (B) it gives oxygen on heating
(C) it melts at very high temperature   (D) it has no effect of electricity

Q.84   Purpose of smelting of an ore is
(A) To oxidise it   (B) To reduce it
(C) To remove vaporisable impurities   (D) To obtain an alloy

Q.85   The role of calcination in metaullurgical operation is
(A) To remove moisture   (B) To decompose carbonates
(C) To decompose organic matter   (D) To achieve all the above

Q.86   The metallurgical process in which metal is obtained in fused state from its ore is called
(A) Smelting   (B) Roasting   (C) Calcination   (D) Froth floatation

Q.87   Which of the following processes involves smelting
(A) $ZnCO_3 \rightarrow ZnO + CO_2$ (B) $Fe_2O_2 + 3\ CO \rightarrow 2Fe + 3CO_2$
(C) $2PbS + 3O_2 \rightarrow 2\ PbO + 2SO_2$ (D) $Al_2O_3 \cdot 2H_2O \rightarrow Al_2O_3 + 2H_2O$

Q.88   Which of the following ore is subjected to roasting during metallurgical operations for getting the metal oxide
(A) Argentite   (B) Zinc blende   (C) Malachite   (D) Limonite

Q.89   Flux is added to remove
(A) Acidic impurities   (B) Basic impurities
(C) All impurities of ores   (D) Both (A) and (B)

Q.90   Which element is used as a reducing agent in smelting
(A) C   (B) Al   (C) Zn   (D) None of these

Q.91   According to Ellingham diagram, the oxidation reaction of carbon to carbon monoxide may be used to reduce which one of the following oxides at the lowest temperature
(A) Al_2O_3 (B) Cu_2O (C) MgO   (D) ZnO

Q.92 In blast furnace, maximum temperature is in
(A) Zone of fusion
(B) Zone of combustion
(C) Zone of slag formation
(D) Zone of reduction

Q.93 During smelting, an additional substance is added which combines with impurities to form a fusible product. It is known as
(A) slag
(B) mud
(C) gangue
(D) flux

Q.94 Which one of the following reaction is an example of calcination process?
(A) $2Ag + 2HCl + [O] \rightarrow 2AgCl + H_2O$
(B) $2Zn + O_2 \rightarrow 2\,ZnO$
(C) $2\,ZnS + 3O_2 \rightarrow 2\,ZnO + 2SO_2$
(D) $2\,PbCO_3 \cdot Pb(OH)_2 \xrightarrow{\Delta} 3PbO + CO_2\uparrow + H_2O$

Q.95 Which of the following metal is obtained by electrolytic reduction process ?
(A) Fe
(B) Cu
(C) Ag
(D) Mg

Q.96 Heating of ore in the absence of air below its melting point is called
(A) Leaching
(B) Roasting
(C) Smelting
(D) Calcination

Q.97 Which of the following flux is used to remove acidic impurities in metallurgical process?
(A) Silica
(B) Lime stone
(C) Borax
(D) Sodium

Q.98 The process of converting hydrated alumina into anhydrous alumina is called
(A) Roasting
(B) Smelting
(C) Dressing
(D) Calcination

Q.99 Which of the following statements about the advantage of roasting of sulphide ore before smelting is not true?
(A) $\Delta_f G°$ of the sulphide is more negative than that of CS_2
(B) $\Delta_f G°$ is negative for roasting of sulphide ore to oxide
(C) $\Delta_f G$ of carbon reduction of metal oxide to free metal is more negative at higher temperature
(D) Carbon and hydrogen are suitable reducing agents for metal sulphides

Q.100 The value of $\Delta_f G°$ for Cr_2O_3 is $-540\,kJ\,mol^{-1}$ and that of Al_2O_3 is $-827\,kJ\,mol^{-1}$. Is the reduction of Cr_2O_3 by Al is feasible reaction
(A) The data is incomplete
(B) The reaction is feasible
(C) The reaction is not feasible
(D) The reaction may or may not be feasible

Q.101 Heating pyrites in air for oxidation of sulphur is called
(A) Slagging
(B) Smelting
(C) Roasting
(D) None of these

Q.102 Which of the following condition is incorrect for metal oxide formation from metal and oxygen at given temp.
(A) $\Delta H = - ve$
(B) $\Delta S = - ve$
(C) $\Delta S = + ve$
(D) None of these

Q.103 Calcination is not carried out for
(A) Calalmine
(B) Malachite
(C) Chalcopyrite
(D) Dolomite

Q.104 Consider the following statements :

Roasting is carried out to :

(i) convert sulphide ore to metal oxide and metal sulphate

(ii) remove water of hydration

(iii) organic matter is decomposed into volatile substance

(iv) remove arsenic and sulphuric impurities as their oxides

Of these statements :

(A) (i), (ii) and (iii) are correct   (B) Only (i) and (iv) are correct

(C) (i), (ii) and (iv) are correct   (D) All are correct

Q.105 Identify the metal M whose extraction is based on the following reactions :

$MS + 2O_2 \longrightarrow MSO_4$; $2\,MS + 3O_2 \longrightarrow 2MO + 2SO_2$

$MS + 2\,MO \longrightarrow 3M + SO_2$; $MS + MSO_4 \longrightarrow 2M + 2SO_2$

(A) Magnesium   (B) Aluminium   (C) Lead   (D) Tin

Q.106 Which of the following metal is not extracted commercially by carbon reduction process?

(A) Zn   (B) Fe   (C) Hg   (D) Sn

Q.107 Which of the following reaction does not represent to calcination.

(A) $Al(OH)_3 \xrightarrow{\Delta} Al_2O_3$ (B) $ZnS + O_2 \xrightarrow{\Delta} ZnSO_4$

(C) $CuCO_3.Cu(OH)_2 \rightarrow CuO + CO_2 + H_2O$ (D) $MgCl_2.6H_2O \xrightarrow[\text{Dry HCl}]{\Delta} MgCl_2$

Q.108 An ore after levigation is found to have acidic impurities . Which of the following can be used as flux during smelting operation?

(A) $Na_2B_4O_7$ (B) $CaCO_3$ (C) SiO_2 (D) Na_3PO_4

Q.109 Which of the following reactions represent(s) the self-reduction process?

(A) $\begin{cases} HgS + O_2 \rightarrow HgO + SO_2 \\ HgO + HgS \rightarrow Hg + SO_2 \end{cases}$ (B) $\begin{cases} Cu_2S + O_2 \rightarrow Cu_2O + SO_2 \\ Cu_2S + Cu_2O \rightarrow Cu + SO_2 \end{cases}$

(C) $\begin{cases} PbS + O_2 \rightarrow PbO + SO_2 \\ PbO + PbS \rightarrow Pb + SO_2 \end{cases}$ (D) All of these

Q.110 Which of the following represents thermite reduction?

(A) $3Mn_3O_4 + 8Al \longrightarrow 9Mn + 4Al_2O_3$ (B) $Al_2O_3 + 3Mg \xrightarrow{\Delta} 2Al + 3MgO$

(C) $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$ (D) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

Q.111 Choose the correct option for the following statements

Statement-1 Sulphide ore is firstly converted to oxide and then it is subjected to reduction for the extraction of metal.

Statement-2 In calcination, the ore is heated in a regular supply of air in a furnace at a temperature below melting point of the calcined product.

Statement-3 Carbon can be used in place of Mg metal during commercial extraction of Ti-metal in Kroll process.

Statement-4 In commercial extraction of Mn by Thermite process, three parts of MnO_2 and one part of Al as reductant, is used.

(A) TTFF   (B) FFFT   (C) TFFT   (D) TFFF

Q.112 Extraction of manganese from Mn_3O_4 by the use of aluminium is an example of :
(A) Amalgamation   (B) hydrometallurgy   (C) electrometallurgy   (D) Pyrometallurgy

Q.113 Slag is formed by reaction between:
(A) impurities and coke   (B) impurities and ore
(C) impurities and flux   (D) flux and coke

Q.114 The slag consists of molten impurities, generally, in the form of:
(A) Metal carbonate   (B) Metal silicate
(C) Metal oxide   (D) Metal nitrate

Q.115 Refractory materials are used in furnaces because
(A) they maintain temperature of the furnace   (B) they can withstand high temperature
(C) they prevent formation of CO   (D) they help in burning of coal

Q.116 Which of the following statement is correct regarding the slag obtained during the extraction of a metal like copper or iron?
(A) The slag is lighter and has lower melting point than the metal
(B) The slag is heavier and has lower melting point than the metal
(C) The slag is lighter and has higher melting point than the metal
(D) The slag is heavier and has higher melting point than the metal

Q.117 Among the following groups of oxides, the group containing oxides that is reduced by carbon for their respective extraction.
(A) CaO and K_2O (B) Fe_2O_3, ZnO and SnO_2
(C) Al_2O_3, B_2O_3 (D) Cr_2O_3, Mn_3O_4

Q.118 Which of the following match is incorrect

Extraction Method	Metal(s)
(A) Self reduction	Hg, Pb
(B) Electrolytic reduction	Na, Al
(C) Hydrometallurgy	Pb, Zn
(D) Alumino-thermite reduction	Mn, Cr

Q.119 Heating of pyrites in air for oxidation of sulphur is called
(A) Roasting   (B) Calcination   (C) Smelting   (D) Levigation

Q.120 Which is not basic flux
(A) Lime stone   (B) SiO_2 (C) Magnesite   (D) None

Q.121 In the extraction of iron lime stone added to the blast furnace, calcium ion is obtained mainly in the form of
(A) $CaSiO_3$ (B) $CaCO_3$ (C) Ca   (D) CaO

Q.122 The slag obtained during the extraction of copper from copper pyrites is composed mainly of
(A) $CaSiO_3$ (B) $FeSiO_3$ (C) $CuSiO_3$ (D) SiO_2

Q.123 Which of the following reaction taking place in the Blast furnace is endothermic
(A) $CaCO_3 \rightarrow CaO + CO_2$
(B) $2C + O_2 \rightarrow 2CO$
(C) $C + O_2 \rightarrow CO_2$
(D) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Q.124 In the modern blast furnaces, in the extraction of iron the charge consists of a mixture of
(A) Fe_2O_3 + lime stone + anthracite coal
(B) Fe_2O_3 + limestone + coke
(C) $Fe_2O_3.3H_2O$ + dolomite + coke
(D) Iron pyrites + lime stone + bituminous coal

Q.125 A metal obtained directly by roasting of its sulphide ore is
(A) Cu
(B) Pb
(C) Hg
(D) Zn

Q.126 Heating mixture of Cu_2O and Cu_2S will give
(A) $Cu + SO_2$
(B) $Cu + SO_3$
(C) $CuO + CuS$
(D) $Cu_2O + S$

Q.127 In the extraction of copper from its sulphide ore, the metal is 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)

Q.128 Alumino-thermite process is used for the extraction of
(A) Al
(B) Cr
(C) Fe
(D) Cu

Q.129 In alumino-thermite process, aluminium is used as
(A) Oxidising agent
(B) Flux
(C) Reducing agent
(D) Ignition agent

Q.130 Aluminium is extracted in large quantities by
(A) Heating cryolite in a limited quantity of air
(B) Reducing aluminium oxide with coke
(C) Reducing aluminium oxide with sodium
(D) Electrolysing aluminium oxide dissolved in fused cryolite

Q.131 After partial roasting, the sulphide of lead is reduced by
(A) Reduction by carbon
(B) Electrolysis
(C) Self-reduction
(D) Cyanide process

Q.132 Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of
(A) $Al_2O_3 + HF + NaAlF_4$
(B) $Al_2O_3 + CaF_2 + NaAlF_4$
(C) $Al_2O_3 + Na_3AlF_6 + CaF_2$
(D) $Al_2O_3 + KF + Na_3AlF_6$

Q.133 Extraction of chromium from chromic oxide, the method used is
(A) Alumino-thermic process
(B) Electrolytic reduction
(C) Carbon reduction
(D) Carbon monoxide reduction

Q.134 Bauxte ore is made up of $Al_2O_3 + SiO_2 + TiO_2 + Fe_2O_3$. The ore is treated with conc. NaOH solution at 500 K and 35 bar pressure for few hours and filtered, In the filtrate the species present, are
(A) $NaAlO_2$ only
(B) $Na_2Ti(OH)_6$ only
(C) Both $NaAlO_2$ and Na_2SiO_3
(D) Na_2SiO_3 only

Q.135 The autoreduction process is not used for extraction of
(A) Hg   (B) Cu   (C) Pb   (D) Fe

Q.136 Pb and Sn are extracted from their chief ore respectively by.
(A) Carbon reduction and self reduction   (B) Self reduction and carbon reduction.
(C) Electrolysis and self reduction.   (D) Self reduction and electrolysis.

Q.137 Slag formed during extraction of iron is
(A) Fe_3C (B) $FeSiO_3$ (C) $MgSiO_3$ (D) $CaSiO_3$

Q.138 The methods chiefly used for the extraction of lead and tin from their ores are respectively.
(A) Self reduction and carbon reduction   (B) Self reduction and electrolytic reduction
(C) Carbon reduction and self reduction   (D) Cyanide process and carbon reduction

Q.139 Complex is formed in the extraction of
(A) Fe   (B) Cu   (C) Ag   (D) Na

Q.140 Spiegelesin is an alloy of
(A) Fe, Co and Cr   (B) Fe, Co and Mg   (C) Fe, Mg and C   (D) Fe, C and Mn

Q.141 From which of the following ore, the concerned metal is not commercially extracted by self reduction.
(A) Ag_2S (B) PbS   (C) $CuFeS_2$ (D) Cu_2S

Q.142 The reduction of a metal oxide by aluminium is called:
(A) Ellingham process   (B) Goldschmidt's aluminothermite process
(C) Kroll's process   (D) Van Arkel process

Q.143 Blister Cu contains about:
(A) 60 % Cu   (B) 90 % Cu   (C) 98 % Cu   (D) 100 % Cu

Q.144 Self-reduction of Cu_2S to Cu is carried out in .... step
(A) Roasting   (B) Smelting   (C) Bessemerization   (D) Poling

Q.145 In which of the following process, silver metal can not be obtained.
(A) As a by product in the electrolytic refining of copper
(B) Parke's process
(C) By reaction of argentite ore with excess KCN followed by metal displacement
(D) By treatment of Horn silver with Aqua Regia

Q.146 Incorrect reduction process is :
(A) $2[Ag(CN)_2]^- + Zn \longrightarrow [Zn(CN)_4]^{2-} + 2Ag$

(B) $Cu_2O + H_2 \xrightarrow{\Delta} 2Cu + H_2O$

(C) $ZnO + Cu \xrightarrow{\Delta} Zn + CuO$

(D) $TiCl_4 + 2Mg \xrightarrow{\Delta} Ti + 2MgCl_2$

Q.147 In which of the following isolations no reducing agent is required:
(A) Iron from haematite   (B) Tin from Tinstoe
(C) Mercury from cinnabar   (D) Zinc from zinc blende

Q.148 Which of the following combination of reactions is involved during commercial extraction of copper metal

(A) $Cu_2S + \dfrac{3}{2}\ O_2 \xrightarrow{\Delta} Cu_2O + SO_2$; $Cu_2O + C \xrightarrow{\Delta} Cu + CO$

(B) $Cu_2S + \dfrac{3}{2}\ O_2 \xrightarrow{\Delta} Cu_2O + SO_2$; $2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu + SO_2$

(C) $Cu_2S + \dfrac{3}{2}\ O_2 \xrightarrow{\Delta} Cu_2O + SO_2$; $2Cu_2O + Si \xrightarrow{\Delta} 4Cu + SiO_2$

(D) $Cu_2S + \dfrac{3}{2}\ O_2 \xrightarrow{\Delta} Cu_2O + SO_2$; $Cu_2O + CO \xrightarrow{\Delta} 2Cu + CO_2$

Q.149 Iron obtained directly from blast furance is:
(A) wrought iron   (B) cast iron   (C) pig iron   (D) steel

Q.150 Which one of the following reactions will occur on heating $AgNO_3$?
(A) $2AgNO_3 \longrightarrow 2Ag + N_2 + 3O_2$ (B) $3AgNO_3 \longrightarrow Ag_2O + N_2O_3 + O_2$
(C) $2AgNO_3 \longrightarrow 2AgNO_2 + O_2$ (D) $2AgNO_3 \longrightarrow 2Ag + NO_2 + O_2$

Q.151 Boron can be obtained by various methods but not by:
(A) thermal decomposition of B_2H_6 (B) pyrolysis of BI_3 (Van Arkel)
(C) Reduction of BCl_3 by H_2 (D) electrolysis of fused BCl_3

Q.152 Black tin is
(A) an alloy of Sn   (B) an allotrope of Sn
(C) 60-70 percent SnO_2 (D) 100 percent SnO_2

Q.153 Incorrect statement during extraction of Al by Hall-Heroult process is :
(A) cryolite $Na_3[AlF_6]$ lowers the working temperature.
(B) Al is obtained at cathode and probably CO at anode
(C) Anode rods are disintegrated due to their oxidation
(D) Pure aluminium floats above molten electrolyte.

Q.154 Which of the following species is desirable substance in extraction of copper but not in extraction of iron?
(A) $CaSiO_3$ (B) $FeSiO_3$ (C) SiO_2 (D) coke

Q.155 Main source of lead is PbS. It is converted to Pb by:

(A) : $PbS \xrightarrow[\Delta]{air} PbO + SO_2$ (B) : $PbS \xrightarrow[\Delta]{air} PbO + PbS$
$\quad \downarrow c \rightarrow Pb + CO_2$ $\quad \downarrow \rightarrow Pb + SO_2$

Self-reduction pocess is:
(A) A   (B) B   (C) both   (D) none

Q.156 Which of the following reaction does not occur in Bessemer's converter?
(A) $FeS + Cu_2O \longrightarrow Cu_2S + FeO$
(B) $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2\uparrow$
(C) $2CuFeS_2 + O_2 \longrightarrow Cu_2S + 2FeS + SO_2$
(D) $FeO + SiO_2 \longrightarrow FeSiO_3$

Q.157 In McArthur forest method zinc powder is used as
(A) oxidising agent (B) reducing agent (C) solvent (D) solvating agent

Q.158 The metal which can be extracted by both sea-water and ores from the earth's crust is:
(A) Magnesium (B) Lead (C) Iron (D) Aluminium

Q.159 Electrolyte used in the commercial extraction of aluminium is :
(A) $Al(OH)_3$ in NaOH solution
(B) Molten mica and CaF_2
(C) Molten mixture of Al_2O_3, Na_3AlF_6 & CaF_2
(D) Molten potash alum

Q.160 Use T if statement is true and F if it is false for following statement.
(i) Cu metal is extracted from its sulphide ore by reduction of Cu_2O with FeS.
(ii) Calamine containing impurity of $FeCr_2O_4$ is concentrated by magnetic separation.
(iii) Self reduction is used for the extraction of Cu & Hg.
(iv) Cassiterite and Rutile are oxide ores of their respective metals
(A) TFTT (B) TIFT (C) FTTT (D) FFFT

Q.161 During extraction of aluminium the carbon anodes are replaced periodically because:
(A) carbon anodes are gradually lost due to formation of Al_4C_3
(B) Carbon anodes melt and mix up with the electrolyte
(C) Oxygen liberated at the carbon anode reacts with anode to form CO
(D) Carbon anode reduces Al_2O_3 into Al

Q.162 In the extraction of aluminium
Process X : Used for purification of red bauxite by leaching.
Process Y : Used for purification of white bauxite and removes impurity of Z then correct statement is.
(A) X = Hall and Heroult's process and Z = SiO_2
(B) X = Baeyer's process and Z = SiO_2
(C) X = Serpeck's process and Z = iron oxide
(D) X = Baeyer's process and Z = iron oxide

Q.163 Magnesium is commercially extracted by :
(A) self-reduction process (B) Dow's sea process
(C) Thermite reduction (D) Leaching followed by metal displacement

Q.164 Bauxite is leached with:
(A) N_2 + Coke (B) NaCN (C) NaOH (D) Na_2CO_3

Q.165 Silver ore dissolves in dilute solution of NaCN in the presence of air to form:
(A) AgCN (B) $[Ag(CN)_2]^-$ (C) AgSCN (D) $[Ag(CN)_4^-]$

Q.166 For extraction of sodium from NaCl, the electrolytic mixture $NaCl + KCl + CaCl_2$ is used. During extraction process, only sodium is deposited on cathode but K and Ca do not because
(A) Na is more volatite than K and Ca
(B) Na is less reactive than K and Ca
(C) NaCl is less stable than Na_3AlF_6 and $CaCl_2$
(D) the discharge potential of Na^+ is less than that of K^+ and Ca^{2+} ions.

Q.167 What is the chemical composition of matte?
(A) $Cu_2O + FeS$ (B) $Cu_2O + Cu_2S$ (C) $FeS + SiO_2$ (D) $Cu_2S + FeS$

Q.168 Dow's process is used for:
(A) Extraction of sodium metal   (B) Extraction of Mg from molten carnallite
(C) Extraction of magnesium from sea water   (D) Purification of aluminium

Q.169 Which of the following reaction occurs in the reduction zone during extraction of iron?
(A) $CaO + SiO_2 \longrightarrow CaSiO_3$(slag)   (B) $Fe_2O_3 + 3C \longrightarrow 2Fe + CO$
(C) $FeO + CO \longrightarrow Fe + CO_2$ (D) $CO_2 + C \longrightarrow 2CO$

Q.170 In the metallurgy of iron, the upper layer obtained at the bottom of blast furnace mainly contains:
(A) $CaSiO_3$ (B) Spongy iron   (C) Fe_2O_3 (D) $FeSiO_3$

Q.171 In the extraction of aluminium during electrolysis stage:
(A) Al_2O_3 undergoes dissociation
(B) AlF_3 undergoes dissociation
(C) Al_2O_3 and AlF_3 both underg'o dissociation
(D) Neither of the two undergoes dissociation

Q.172 In the extraction of copper from its sulphide ore the metal is formed by the reduction of Cu_2O with:
(A) FeS   (B) CO   (C) Cu_2S (D) SO_2

Q.173 Which one of the following statements is incorrect?
(A) Tin is extracted by carbon reduction (smelting)
(B) Aluminium is extracted by Hall's process which involves carbon reduction.
(C) Extraction of lead does not involve bessemerisation
(D) Silver is extracted by cyanide process

Q.174 Fused carnallite on electrolysis gives:
(A) Ca and Cl_2 (B) Na and CO_2 (C) Al and Cl_2 (D) Mg and Cl_2

REFINING

Q.175 Van Arkel method of purification of metals involves converting the metal to a
(A) Volatile stable compound
(B) Volatile thermally unstable compound
(C) Non volatile stable compound
(D) None of the above

Q.176 If the impurity in a metal has a greater affinity for oxygen and is more easily oxidised than the metal, then the purification of metal may be carried out by
(A) Cyanidation   (B) Zone refining   (C) Electrolytc refining   (D) Cupelation

Q.177 (Ag + Pb) alloy $\xrightarrow{\text{Melt and zinc is added}}$ (Ag + Pb + Zn) melt $\xrightarrow{\text{Cool}}$ $\xrightarrow[\text{Bottom Layer (Y)}]{\text{Upper Layer (X)}}$ Select

correct statement based on above scheme
(A) Layer X contain Zn and Ag
(B) Layer Y contains Pb and Ag but amount of silver in this layer is smaller than in layer X
(C) X and Y are immiscible layer
(D) All are correct statements

Q.178 The method of zone refining is based on the principle of
(A) Greater solubility of the impurity in the molten state than in the solid
(B) Greater mobility of the pure metal than that of the impurity
(C) Higher melting point of the impurity than that of the pure metal
(D) Greater noble character of the solid metal than that of the impurity

Q.179 Van-Arkel method of purification of metals involves converting the metal to a
(A) Volatile thermally stable compound   (B) Non-volatile stable compound
(C) Volatile thermally unstable compound   (D) None of the above

Q.180 Zone refining is based on the principle of
(A) fractional distillation   (B) fracitonal crystallisation
(C) partitition coefficient   (D) chromatographic separation

Q.181 In electrorefining of metals , the anode is made of :
(A) Impure metal concerned   (B) Pure metal concerned
(C) Graphite   (D) Platinum

Q.182 Which of the following statement is incorrect?
(A) Liquation is applied when the metal has low melting point than those of impurities.
(B) Presence of carbon in steel makes it hard due to having cementite impurity.
(C) Less reactive metals like Hg, Pb and Cu are obtained by auto reduction from their sulphide ores.
(D) Amalgamation is used for purification of mercury

Q.183 Zinc does not form alloy with
(A) Cu   (B) Sn   (C) Pb   (D) Ag

Q.184 Which of the following process involves the principle of fractional crystallisation for refining of an element?
(A) Parke's process   (B) Mond's process   (C) Van Arkel process   (D) Zone refining

Q.185 Mg can be obtained by:
(A) heating $MgCl_2$(anhydrous) with Na in the atmosphere of coal gas
(B) electrolysis of fused anhydrous carnallite
(C) both methods
(D) one of.the above.

Q.186 $NaCl$ and $CaCl_2$ are added to fused $MgCl_2$ during extraction of Mg because.
(A) Melting point of electrolyte is decreased and its conductivity is increased
(B) Melting point of electrolyte is increased and its conductivity is decreased
(C) Both melting point and conductivity of electrolyte are decreased
(D) Both melting point and conductivity of electrolyte are increased

Q.187 Incorrect match is
(A) Bayer's method   NaOH solution
(B) Matte   98% CuS + 2% FeS
(C) Van Arkel method BI_3
(D) Thomas slag   Bessemerization

Q.188 Purest form of iron is :
(A) cast iron   (B) wrought iron   (C) pig iron   (D) None of these

Q.189 Tempering of steel:
(A) to obtain steel of a particular hardness
(B) increases mechanical strength
(C) changes content of carbon in the form of cementite
(D) All of the above

Q.190 Bessemerisation is used in the extraction / Refining of
I : Fe   II : Cu   III : Al   IV: Silver
(A) I, II   (B) II, III   (C) I, III   (D) all

Q.191 The method of extraction of Ag by cyano complex formation followed by metal displacement is called:
(A) Parke's method   (B) McArthur-Forest method
(C) Serpeck method   (D) Hall's method

Q.192 Silica is added during extraction of copper in order to remove
(A) cuprous sulphide   (B) ferrous oxide
(C) cupric oxide   (D) cuprous oxide

Q.193 Addition of manganese makes steel useful in making rails of railroads, because manganese
(A) gives hardness to steel   (B) helps the formation of oxides of iron
(C) reduces impurity of SiO_2 into silicon   (D) reduces hardness

Q.194 A piece of steel is heated to red hot and then it is dipped into cold water, this treatment of iron makes it
(A) soft and malleable   (B) hard but not brittle
(C) more brittle   (D) hard and brittle

Q.195 Modern method of steel manufacturing is
(A) open hearth process   (B) L.D. Process
(C) Bessemerisation   (D) Cupellation

Q.196 The chemical process of manufacturing of steel from its ore haematite involves
(A) oxidation   (B) reduction followed by oxidation
(C) oxidation followed by reduction   (D) oxidation followed by decomposition and reduction

Q.197 Which of the following metal acts as scavenger in steal manufacturing.
(A) Cr   (B) Mn   (C) Ti   (D) Pb

Q.198 Railway wagon axles are made by
(A) Sherardising   (B) Annealing   (C) Tempering   (D) Case hardening

Q.199 In electrolytic refining of metals, electrolysis of an aqueous solution of its complex salt is done with impure metal as anode and an strip of pure metal as cathode. This method cannot be used for the refining of the metal
(A) Silver   (B) Copper   (C) Aluminium   (D) Zinc

Q.200 Cupellation process is used in the metallugry of
(A) Copper   (B) Silver   (C) Aluminium   (D) Iron

Q.201 Zone refining is a method to obtain
(A) Ultra pure Hg   (B) Ultra pure Lead   (C) Ultra pure Silicon   (D) Ultra pure Sn

Q.202 Metal which is refined by poling is
(A) Sodium   (B) Blister copper   (C) Zinc   (D) Silver

Q.203 Silver obtained from argentiferrous lead containing lead impurity is purified by
(A) Distillation   (B) Froth floatation
(C) Cupellation   (D) Aqueous NaCN in absence of air

Q.204 The method not used in metallurgy to refine the impure metal is
(A) Mond's process   (B) Van-Arkel process   (C) Froth floatation   (D) Liq uation

Q.205 Method used for obtaining ultra pure silicon used as a semiconductor material is
(A) Oxidation   (B) Electrochemical   (C) Crystallization   (D) Zone refining

Q.206 In electrorefining of copper, some gold is deposited as
(A) anode mud   (B) cathode mud   (C) flux   (D) slag

Q.207 Which method of purification is represented by the following equation?

$$Ti(s) + 2I_2 (g) \xrightarrow{523K} TiI_4 (g) \xrightarrow{1700K} Ti(s) + 2I_2 (g)$$

(A) Zone refining   (B) Cupellation   (C) Poling   (D) Van-Arkel

Q.208 Refining of silver is carried out by :
(A) Liquation   (B) Poling   (C) Cupellation   (D) Vapour phase refining

Q.209 Which does not represent correct method?

(A) $TiCl_4 + 2 Mg \xrightarrow{\Delta} Ti + 2MgCl_2$: Kroll process

(B) $Ni(CO)_4 \xrightarrow{\Delta} Ni + 4CO$: Mond's process

(C) $PbI_2 \xrightarrow{\Delta} Pb + I_2$: Van Arkel process

(D) $ZrI_4 \xrightarrow{\Delta} Zr + 2I_2$: Van Arkel process

Q.210 In the form of by product, tungstan is mainly obtained during electrolysis refining of :
(A) Pb   (B) Sn   (C) Cu   (D) Al

Q.211 In the extraction of nickel by Mond's process, the metal is obtained by:
(A) electrochemical reduction   (B) thermal decomposition
(C) chemical reduction by aluminium   (D) reduction by carbon

Q.212 When copper is purified by electrorefining process, noble metals like Ag and Au are found in
(A) cathode mud   (B) over anode
(C) anode mud   (D) over cathode or anode

Q.213 Formation of $Ni(CO)_4$ and subsequent its decomposition into Ni and CO (recycled) makes basis of Mond's process

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

T_1 and T_2 are:
(A) 100°C, 50°C   (B) 50°C, 100°C   (C) 50°C, 230°C   (D) 230°C, 50°C

Q.214 In making of steel, phosphorous separates as :
(A) Slag. $Ca_3(PO_4)_2$ (B) volatile, P_2O_5 (C) slag, $FePO_4$ (D) Ca_3P_2

Q.215 Incorrect statement regarding silver extraction process is :
(A) When the lead-silver composition is rich in silver, lead is removed by the cupellation process.
(B) When lead-silver composition is rich in lead, most of lead is removed by Pattinson's process.
(C) Zinc forms an alloy with lead, from which lead is separated by distillation
(D) Zinc dissolves silver, from which zinc is separated by distillation.

Q.216 Which process is based on Distribution law
(A) Pattinson's process (B) Parke's process   (C) Kroll process   (D) Moisson process

Q.217 During poling which of the following oxide(s) is/are not reduced by hydrocarbons.
(A) SnO_2 (B) Fe_2O_3 (C) Cu_2O (D) both A and C

Q.218 Ultrapure form of Si and Ge are obtained from.
(A) zone-refining   (B) electrorefining
(C) Van-Arkel's process   (D) cupellation process

Q.219 The metal for which, its property of forming of volatile complex is used for its purification.
(A) Cobalt   (B) Nickel   (C) Vanadium   (D) Iron

Q.220 In the purification of aluminium by Hoope's process, impurities of silicon and copper are added to the molten impure aluminium in order to :
(A) make the melt conducting   (B) reduce CaO into Ca
(C) smooth deposition of aluminium ion (D) make the melt heavier

Q.221 In electrorefining of metal, the anode is made of thick plate of impure metal and this method is not used for 1 refining of :
(A) Silver   (B) Copper   (C) Aluminium   (D) Gold

Q.222 % of silver in 'german silver' is
(A) 0   (B) 80   (C) 90   (D) 10

Q.223 Which method of purification is presented by the following reactions?

$$Ti + 2I_2 \xrightarrow{500\,K} TiI_4 \xrightarrow{1675\,K} Ti + 2I_2$$
(Impure)   (Pure)
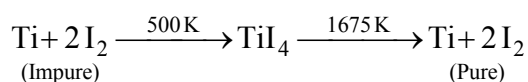
(A) Cupellation   (B) Polling   (C) Van Arkel   (D) Zone refining

Q.224 Which of the following metals may be present in the anode mud during electrorefining of copper?
I. Gold ;   II. Iron ;   III. Silver   ;   IV. magnesium
(A) I and II   (B) II and IV   (C) I and III   (D) III and IV

Q.225 Mercury is purified by:
(A) Leaching   (B) Distillation   (C) Cupellation   (D) Vapour phase refining

Q.226 Which is not correctly matched :
(A) Spiegleisan : Mn + Fe+C   (B) Dow's sea water process : $Ca(OH)_2$
(C) Parke's process : Ag   (D) Liquation : Spelter (Impure Zn)

Q.227 Silver and gold are often obtained as valuable by-products during:
(A) Smelting   (B) Electrolytic refining
(C) Zone refining   (D) Iron making

Q.228 Extraction of pure Zn metal from its sulphide ore does not involve
(A) Roasting   (B) Distillation   (C) Self reduction   (D) Rapid Cooling

Q.229 Which of the following match is incorrect

Extraction Method	Metal(s)
(A) Self reduction	Hg, Pb
(B) Electrolytic reduction	Na, Al
(C) Hydrometallurgy	Pb, Zn
(D) Alumino-thermite reduction	Mn, Cr

Q.230 Which of the following metal is commercially extracted by Pyrometallurgy
(A) Ag   (B) Al   (C) Cu   (D) Mg

EXERCISE-2
SECTION-A
(JEE Main Previous Year's Questions)

Q.1   Aluminium is industrially prepared by :   **[AIEEE- 2002]**

(A) Fused cryolite   (B) Bauxite ore   (C) Alumina   (D) Borax

Q.2   Which one of the following ores is best concentrated by froath-flotation method ?   **[AIEEE 2004]**

(A) Magnetite   (B) Cassiterite   (C) Galena   (D) Malachite

Q.3   During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are –   **[AIEEE 2005]**

(A) Pb and Zn   (B) Sn and Ag   (C) Fe and Ni   (D) Ag and Au

Q.4   Heating mixture of Cu_2O and Cu_2S will give –   **[AIEEE 2005]**

(A) $Cu + SO_3$ (B) $Cu + SO_2$ (C) Cu_2SO_3 (D) $CuO + CuS$

Q.5   Which of the following factors is of no significance for roasting sulphide ores to the oxides and not subjecting the sulphide ores to 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 the corresponding oxides

(D) CO_2 is more volatile than CS_2

Q.6   Which method of purification is represented by the following equation :   **[AIEEE 2012]**

$$Ti(s) + 2I_2(g) \xrightarrow{523K} TiI_4(g) \xrightarrow{1700K} Ti(s) + 2I_2(g)$$

(A) Poling   (B) Van Arkel   (C) Zone refining   (D) Cupellation

Q.7   The metal that cannot be obtained by electrolysis of an aqueous solution of its salts is:

(A) Ca   (B) Cu   (C) Cr   (D) Ag   **[JEE Main 2014]**

Q.8   Which series of reactions correctly represents chemical relations related to iron and its compound ?

(A) $Fe \xrightarrow{O_2,heat} FeO \xrightarrow{dil H_2SO_4} FeSO_4 \xrightarrow{heat} Fe$ **[JEE Main 2014]**

(B) $Fe \xrightarrow{Cl_2,heat} FeCl_3 \xrightarrow{heat,air} FeCl_2 \xrightarrow{Zn} Fe$

(C) $Fe \xrightarrow{O_2,heat} Fe_3O_4 \xrightarrow{CO,600°C} FeO \xrightarrow{CO,700°C} Fe$

(D) $Fe \xrightarrow{dil H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4,O_2} Fe_2(SO_4)_3 \xrightarrow{heat} Fe$

Q.9 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 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

Q.10 Galvanization is applying a coating of : **[JEE Main 2016]**

(A) Zn   (B) Pb   (C) Cr   (D) Cu

Q.11 Which one of the following ores is best concentrated by froth floatation method? **[JEE Main 2016]**

(A) Malachite   (B) Magnetite   (C) Siderite   (D) Galena

Q.12 When metal 'M' is treated with NaOH, a white gelatinous precipitate 'X' is obtained which is soluble in excess of NaOH. Compound 'X' when heated strongly gives an oxide which is used in chromatography as an adsorbent. The metal 'M' is : **[JEE Main 2018]**

(A) Al   (B) Fe   (C) Zn   (D) Ca

SECTION-B
(JEE ADVANCED Previous Year's Questions)

Q.1   Answer the following questions briefly: **[1987]**
   (i)   What is the actual reducing agent of haematite in blast furance?
   (ii)   Give the equations for the recovery of lead from galena by air reduction.
   (iii) Why is sodium chloride added during electrolysis of fused anhydrous magnesium chloride?
   (iv)   Why copper metal is not used for the recovery of metallic silver from complex $[Ag(CN)_2]^-$ explain.
   (v)   Why is chalcocite roasted and not calcinated during recovery of copper?

Q.2   In extractive metallurgy of zinc partial fusion of ZnO with coke is called _____ and reduction of the ore to the molten metal is called _____ (smelting, calcining, roasting, sintering).   **[1988]**

Q.3   Write balanced equation for "the extraction of copper from copper pyrites by self reduction." **[1990]**

Q.4   Give briefly the isolation of magnesium from sea water by the Dow's process. Give equations for the steps involved.   **[1993]**

Q.5   Give reasons for the following: **[1994]**
   "Although aluminium is above hydrogen in the electrochemical series, it is stable in air and water."

Q.6   Give balanced equations for the following: **[1998]**
   " Extraction of silver from silver glance by cyanide process."

Q.7   In the commercial electrochemical process for aluminium extraction, the electrolyte used as: **[1999]**
   (A) $Al(OH)_3$ in NaOH solution   (B) an aqueous solution of $Al_2(SO_4)_3$
   (C) a molten mixture of Al_2O_3 and Na_3AlF_6 (D) a molten mixture of AlO(OH) and $Al(OH)_3$

Q.8   The chemical process in the production of steel from haematite ore involve: **[2000 Qualifying]**
   (A) reduction   (B) oxidation
   (C) reduction followed by oxidation   (D) oxidation followed by reduction

Q.9   The chemical composition of "slag" formed during the smelting process in the extraction of copper is:
                                                                                              [2001 Qualifying]
   (A) $Cu_2O + FeS$ (B) $FeSiO_3$ (C) $CuFeS_2$ (D) $Cu_2S + FeO$

Q.10 Which of the following processes is used in extractive metallurgy of magnesium? **[2002 Qualifying]**
   (A) Fused salt electrolysis   (B) Self reduction
   (C) Aqueous solution electrolysis   (D) Thermite reduction

Q.11 In the process of extraction of gold,

   Roasted gold ore $+ CN^- + H_2O \xrightarrow{O_2}$ [X] $+ OH^-$
                           [X] $+ Zn \longrightarrow$ [Y] $+ Au$
   Identify the complexes [X] and [Y] :   **[2003 Qualifying]**
   (A) X = $[Au(CN)_2]^-$, Y = $[Zn(CN)_4]^{2-}$ (B) X = $[Au(CN)_4]^{3-}$, Y = $[Zn(CN)_4]^{2-}$
   (C) X = $[Au(CN)_2]^-$, Y = $[Zn(CN)_6]^{4-}$ (D) X = $[Au(CN)_4]^-$, Y = $[Zn(CN)_4]^{2-}$

Q.12 The methods chiefly used for the extraction of lead and tin from their ores are respectively: **[2004]**
   (A) self reduction and carbon reduction   (B) self reduction and electrolytic reduction
   (C) carbon reduction and self reduction   (D) cyanide process and carbon reduction

Q.13   Which ore contains both iron and copper ?   [2004]
(A) Cuprite   (B) Chalcocite   (C) Chalcopyrite   (D) Malachite

Q.14   Match the extraction processes listed in column I with metals listed in column II.   [2006]

Column I		Column II	
(A)	Self reduction	(P)	Lead
(B)	Carbon reduction	(Q)	Silver
(C)	Complex formation and displacement by metal	(R)	Copper
(D)	Decomposition o iodide	(S)	Boron

Q.15   Extraction for zinc from zinc blende is achieved by: [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.16   Native silver metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of
(A) nitrogen   (B) oxygen   (C) carbon dioxide   (D) argon   [2008]

Q.17   Match the conversions in **Column I** with the type(s) of reaction(s) given in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.   [2008]

Column I		Column II	
(A)	$PbS \rightarrow PbO$	(P)	Roasting
(B)	$CaCO_3 \rightarrow CaO$	(Q)	Calcination
(C)	$ZnS \rightarrow Zn$	(R)	Carbon reduction
(D)	$Cu_2S \rightarrow Cu$	(S)	Self reduction

Paragraph for Questions 18 to 20

Copper is the most noble of the first row transition metals and occurs in small deposits in several countries. Ores of copper include chalcanthite ($CuSO_4 \cdot 5H_2O$), atacamite ($Cu_2Cl(OH)_3$), cuprite (Cu_2O), copper glance (Cu_2S) and malachite ($Cu_2(OH)_2CO_3$). However, 80% of the world copper production comes from the ore chalcopyrite ($CuFeS_2$). The extraction of copper from chalopyrite involved partial roasting, removal of iron and self-reduction.

Q.18   Partial roasting of chalcopyrite produces   [2010]
(A) Cu_2S and FeO (B) Cu_2O and FeO
(C) CuS and Fe_2O_3 (D) Cu_2O and Fe_2O_3

Q.19   Iron is removed from chalcopyrite as   [2010]
(A) FeO (B) FeS (C) Fe_2O_3 (D) $FeSiO_3$

Q.20   In self-reduction, the reducing species is   [2010]
(A) S (B) O^{2-} (C) S^{2-} (D) SO_2

Q.21   Extraction of metal from the ore **cassiterite** involves   [2011]
(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.22 Oxidation states of the metal in the minerals haematite and magnetite, respectively, are   **[2011]**
(A) II, III in haematite and III in magnetite   (B) II, III in haematite and II in magnetite
(C) II in haematite and II, III in magnetite   (D) III in haematite and II, III in magnetite

Q.23 In the cyanide extraction process of silver from argentite ore, the oxidizing and reducing agents used are:
(A) O_2 and CO respectively   (B) O_2 and Zn dust respectively   **[2012]**
(C) HNO_3 and Zn dust respectively   (D) HNO_3 and CO respectively

Q.24 Sulfide ores are common for the metals :   **[JEE Advance 2013]**
(A) Ag, Cu and Pb   (B) Ag, Cu and Sn
(C) Ag, Mg and Pb   (D) Al, Cu and Pb

Q.25 The carbon-based reduction method is **NOT** used for the extraction of   **[JEE Advance 2013]**
(A) tin from SnO_2 (B) iron from Fe_2O_3
(C) aluminium from Al_2O_3 (D) magnesium from $MgCO_3 \cdot CaCO_3$

Q.26 Upon heating with Cu_2S, the reagent(s) that give copper metal is/are   **[JEE Advance 2014]**
(A) $CuFeS_2$ (B) CuO
(C) Cu_2O (D) $CuSO_4$

Q.27 Copper is purified by electrolytic refining of blister copper. The correct statement(s) about this process is(are):   **[JEE Advance 2015]**
(A) Impure Cu strip is used as cathode
(B) Acidified aqueous $CuSO_4$ is used as electrolyte
(C) Pure Cu deposits at cathode
(D) Impurities settle as anode - mud

Q.28 Match the anionic species given in **Column I** that are present in the ore(s) given in **Column II**

	Column I		**Column II** **[JEE Advance 2015]**
(A)	Carbonate	(P)	Siderite
(B)	Sulphide	(Q)	Malachite
(C)	Hydroxide	(R)	Bauxite
(D)	Oxide	(S)	Calamine
		(T)	Argentite

Q.29 Extraction of copper from copper pyrite ($CuFeS_2$) involves   **[JEE Advance 2016]**
(A) crushing followed by concentration of the ore by froth-flotation
(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

Q.30 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)   **[JEE Advance 2018]**

ANSWER KEY

EXERCISE-1

Q.1	C	Q.2	A	Q.3	A	Q.4	B	Q.5	C	Q.6	D	Q.7	B
Q.8	D	Q.9	A	Q.10	D	Q.11	A	Q.12	B	Q.13	A	Q.14	D
Q.15	A	Q.16	A	Q.17	D	Q.18	C	Q.19	B	Q.20	A	Q.21	B
Q.22	D	Q.23	A	Q.24	B	Q.25	D	Q.26	B	Q.27	C	Q.28	A
Q.29	C	Q.30	D	Q.31	C	Q.32	A	Q.33	D	Q.34	D	Q.35	D
Q.36	D	Q.37	B	Q.38	D	Q.39	C	Q.40	B	Q.41	D	Q.42	D
Q.43	C	Q.44	C	Q.45	D	Q.46	B	Q.47	A	Q.48	B	Q.49	A
Q.50	C	Q.51	B	Q.52	C	Q.53	A	Q.54	B	Q.55	A	Q.56	B
Q.57	A	Q.58	B	Q.59	B	Q.60	C	Q.61	B	Q.62	B	Q.63	D
Q.64	B	Q.65	B	Q.66	D	Q.67	B	Q.68	A	Q.69	B	Q.70	A
Q.71	A	Q.72	D	Q.73	B	Q.74	A	Q.75	C	Q.76	D	Q.77	D
Q.78	B	Q.79	D	Q.80	A	Q.81	B	Q.82	C	Q.83	C	Q.84	B
Q.85	D	Q.86	A	Q.87	B	Q.88	B	Q.89	D	Q.90	A	Q.91	B
Q.92	B	Q.93	D	Q.94	D	Q.95	D	Q.96	D	Q.97	B	Q.98	D
Q.99	D	Q.100	B	Q.101	C	Q.102	C	Q.103	C	Q.104	D	Q.105	C
Q.106	C	Q.107	B	Q.108	B	Q.109	D	Q.110	A	Q.111	D	Q.112	D
Q.113	C	Q.114	B	Q.115	B	Q.116	A	Q.117	B	Q.118	C	Q.119	A
Q.120	B	Q.121	A	Q.122	B	Q.123	A	Q.124	B	Q.125	C	Q.126	A
Q.127	A	Q.128	B	Q.129	C	Q.130	D	Q.131	C	Q.132	C	Q.133	A
Q.134	C	Q.135	D	Q.136	B	Q.137	D	Q.138	A	Q.139	C	Q.140	D
Q.141	A	Q.142	B	Q.143	C	Q.144	C	Q.145	D	Q.146	C	Q.147	C
Q.148	B	Q.149	C	Q.150	D	Q.151	D	Q.152	C	Q.153	D	Q.154	C
Q.155	B	Q.156	C	Q.157	B	Q.158	A	Q.159	C	Q.160	C	Q.161	C
Q.162	B	Q.163	B	Q.164	C	Q.165	B	Q.166	D	Q.167	D	Q.168	C
Q.169	C	Q.170	A	Q.171	B	Q.172	C	Q.173	B	Q.174	D	Q.175	B
Q.176	D	Q.177	D	Q.178	A	Q.179	C	Q.180	B	Q.181	A	Q.182	D
Q.183	C	Q.184	D	Q.185	C	Q.186	A	Q.187	B	Q.188	B	Q.189	D
Q.190	A	Q.191	B	Q.192	B	Q.193	A	Q.194	D	Q.195	B	Q.196	B
Q.197	B	Q.198	D	Q.199	C	Q.200	B	Q.201	C	Q.202	B	Q.203	C
Q.204	C	Q.205	D	Q.206	A	Q.207	D	Q.208	C	Q.209	C	Q.210	B
Q.211	B	Q.212	C	Q.213	C	Q.214	A	Q.215	C	Q.216	B	Q.217	B
Q.218	A	Q.219	B	Q.220	D	Q.221	C	Q.222	A	Q.223	C	Q.224	C
Q.225	B	Q.226	D	Q.227	B	Q.228	C	Q.229	C	Q.230	C		

EXERCISE-2
SECTION-A

Q.1	B	Q.2	C	Q.3	D	Q.4	B	Q.5	C	Q.6	B	Q.7	A
Q.8	C	Q.9	B	Q.10	A	Q.11	D	Q.12	A				

SECTION-B

| Q.2 | sintering , smelting | Q.7 | C | Q.8 | C | Q.9 | B | Q.10 | A | Q.11 | A |

Q.12 A   Q.13 C   Q.14 (A) P, R ; (B) P ; (C) Q ;(D) S   Q.15 B   Q.16 B

Q.17 (A) P; (B) Q; (C) P,R (D) P,S   Q.18 A   Q.19 D   Q.20 C   Q.21 ACD

Q.22 D   Q.23 B   Q.24 A   Q.25 CD   Q.26 BCD   Q.27 BCD

Q.28 (A) PQS (B) T (C) QR (D) R   Q.29 ABC   Q.30 6.47