GENERAL PRINCIPLES AND PROCESS OF ISOLATION OF ELEMENTS – Previous HSE questions

1) Explain the following refining processes :
   (a) Distillation
   (b) Vapour phase refining
   (c) Zone refining [SAY 2018]
2) Gibbs energy of formation (Δ_fG) of MgO(s) and CO(g) at 1273 K and 2273 K are given below:
   Δ_fG [MgO(s)] : -941 kJ mol^{-1} at 1273 K
   Δ_fG [CO(g)] : 439 kJ mol^{-1} at 1273 K
   Δ_fG [MgO(s)] : -314 kJ mol^{-1} at 2273 K
   Δ_fG [CO(g)] : -628 kJ mol^{-1} at 2273 K
   On the basis of the above data, predict the temperature at which carbon can be used as a reducing agent for MgO(s). [March 2018]
3) Which among the following is not an ore of iron?
   i) Haematite ii) Magnetite iii) Malachite iv) Siderite (1)
4) Explain the froth floatation process for the concentration of Ore. (2) [SAY 2017]
5) Leaching is a process of concentration of ores. Explain the leaching of alumina from bauxite. (3) [March 2017]
6) Metals are extracted from their ores.
   a) Among the following which metal is extracted from bauxite.
      (i) Zinc (ii) Iron (iii) Aluminium (Iv) Copper (1)
   b) Sulphide ores are subjected to roasting, while carbonate ores are subjected to calcination. Comment on the statement. (2) [SAY 2016]
7) Which of the following is the ore of zinc ?
   a) Bauxite (b) Magnetite (c) Malachite (d) calamine (1)
   b) There are several methods for refining metals. Explain a method for refining Zirconium. (2) [March 2016]
8) The processes involved in metallurgy are concentration of the ore, isolation of the metal from its concentrated ore and purification of the metal.
   a) Froth floatation method is an ore concentration method. What is the principle behind the process? (1)
   b) What is the role of lime stone ($CaCO_3$) in the extraction of iron? (1)
   c) Mond's process is used for refining of Ni and Van Arkel method is used for refining Zr (zirconium). Write one similarity between these processes. (1) [SAY 2015]
9) a) Name any two metals which can be refined by Van Arkel method. (1)
   b) Match the items of column I with items of column II

Column I	Column II
i) Bauxite	a) Zinc
ii) Malachite	b) Iron
iii) Calamine	c) Copper
iv) Magnetite	d) Aluminium
	e) Lead

   (2) [March 2015]
10) a) Calcination and roasting are pre-treatments in metallurgy before metal extraction. Differentiate between calcinations and roasting? (1)
   b) Match the items of column I with items of column II

Column I	Column II
1. Distillation	a) Ge
2. Liquation	b) Ni
3. Zone refining	c) Cu
4. Vapour phase refining	d) Zn
	e) Sn

   (2) [March 2014]
11) Sulphide ores are concentrated by froth floatation process.
   a) Write the name or formula of any two sulphide ores of copper. (1)

b) Explain the froth floatation process. (2) [SAY 2014]

12) a) Match the items of Column I with items of Column II.

Column I	Column II
i) Aluminium	a) Malalachite
ii) Iron	b) Bauxite
iii) Copper	c) Limestone
iv) Zinc	d) Haematite
	e) Calamine (2)

b) The reduction of the metal oxide is easier if the metal formed is in liquid state, at the temperature of reduction. Give reason. (1) [MARCH 2013]

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

a) Name the method used for removing gangue from sulphide ores. (½)

b) Explain the above method. (1½)

c) Give two examples of alloy steel. (1) [SAY 2013]

14) a) All ores are minerals, but all minerals are not ores. Why? (1)

b) Carbonate ores are subjected to calcinations, while sulphide ores are subjected to roasting. Comment on the statement. (2) [MARCH 2012]

15) Concentrated ore of iron, coke and limestone are fed into a blast furnace from the top.

a) Write down the reason for adding limestone along with the concentrated ore of iron. (1)

b) Write down the reactions taking place at higher temperature range in the blast furnace. (2) [SAY 2012]

16) Metals are extracted from their chief ore.

a) Name the principal ore of Aluminium. (1)

b) Write the equation for the reactions taking place at the anode and the cathode during the extraction of aluminium by the electrolytic process. (2) [SAY 2012]

17) The concept of coupled reactions is used to explain reductions in metallurgy.

a) Explain the above statement. (1)

b) In the blast furnace for manufacturing iron, most of the reduction is carried out by CO rather than coke. How can you account for this? (2) [MARCH 2011]

18) Bauxite is an important ore of aluminium. It is concentrated by leaching. Explain the method. (3) [SAY 2011]

19) Analyse the table given below:

Metal	Ore
Copper	Copper pyrites, Copper glance, Cuprite
Zinc	Zinc blende, Calamine, Zincite
Aluminium	Bauxite, Diaspore
Iron	Haematite, Magnetite, Iron Pyrites

a) Which of the ores mentioned in the above table can be concentrated by magnetic separation method? Justify your answer. (1 ½)

b) Identify the ores that can be concentrated by leaching. (½)

c) What do you mean by leaching? (1) [MARCH 2010]

20) a) A few metallurgical reactions are given below. Classify them as roasting and calcinations.

i) $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$

ii) $ZnCO_3 \rightarrow ZnO + CO_2$

iii) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

iv) $Al_2O_3.xH_2O \rightarrow Al_2O_3 + xH_2O$ (2)

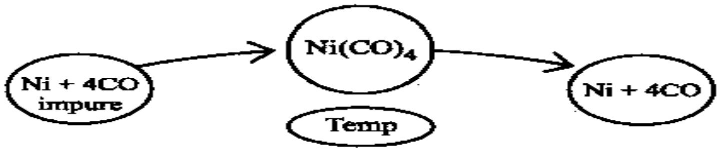
b) Differentiate between calcinations and roasting. (1) [MARCH 2010]

21) a) Do you think that all minerals of iron are used as ores of iron? Substantiate. (1)

b) Name the purest form of iron. (½)

c) How do you obtain the above form of iron? (1) [MARCH 2009]

22) Watch the diagram.



a) Name the metallurgical refining technique used here. (1)

b) Describe the mechanism of purification of Ni by this method. (1)

c) Explain the purification of zirconium. (1) [MARCH 2008]

23) While adding the raw materials into the reverberatory furnace for the extraction of copper, it is forgotten to mix sand.

a) Predict the result of this mistake. (1)

b) Give reason for the result. (1)

c) Write the chemical equation involved for the change of copper pyrites in roasting, during the extraction of copper. (1) [SAY 2008]

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