CBSE Test Paper-05

Class 12 Chemistry (Processes of Isolation of Elements)

1. Gravity separation technique is mainly applicable to
   a. Oxide ore
   b. Sulphide ore
   c. Carbonate ore
   d. Halide ore
2. Leaching of gold is done by
   a. Metal cyanide
   b. Metal silicate
   c. Metal sulphide
   d. Metal hydroxide
3. The second most abundant metal on earth’s crust is
   a. Iron
   b. Zinc
   c. Copper
   d. Aluminium
4. Which among the following act as flux , if iron oxide is present as an impurity?
   a. MnO
   b. SiO_2
   c. H_2SO_4
   d. NaOH
5. When the impurity is silica, which of the following can be used as flux?
   a. All of these
   b. CaO
   c. $MgCO_3$
   d. $CaCO_3$
6. Name the most abundant element in the earth's crust?
7. Name the reducing agent used in alumino thermic (thermite) process.

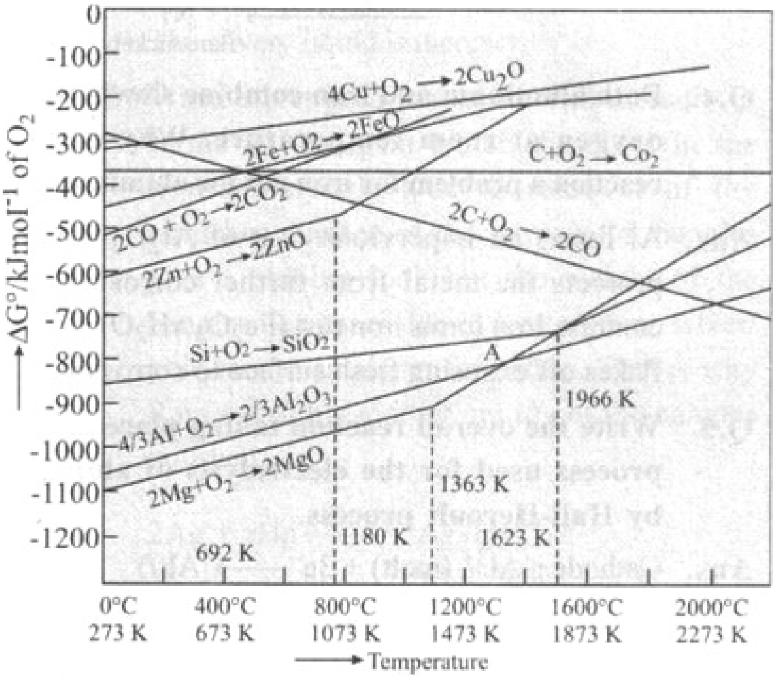
8. What is the role of the cryolite in the metallurgy of aluminium?

9. Write the names of principal ore of zinc.

10. Explain the role of :
    i. Cryolite in the electrolytic reduction of alumina.
    ii. Carbon monoxide in the purification of nickel.

11. What are uses of Zinc?

12. a. What is the thermodynamic consideration in the choice of a reducing agent in metallurgy?
    b. Using the Ellingham diagram given below, predict the following:
        i. At what temperature can silicon reduce MgO?



        ii. At what temperature can aluminium reduce MgO?
        iii. At what temperature can carbon reduce MgO?

13. Predict the modes of occurrence of the following three types of metals:
    i. Highly reactive (e.g. Na)
    ii. Moderately reactive (e.g Fe)
    iii. Noble metal (e.g. Au)

14. Differentiate between 'roasting' and 'calcination' and give example for each.

15. Why zinc cannot be extracted from zinc oxide through reduction using CO?

CBSE Test Paper-05

Class 12 Chemistry (Processes of Isolation of Elements)

Solutions

1. a. Oxide ore

   Explanation: Gravity separation is a technique mainly used for concentration of tin and lead ores as they are heavier.

2. a. Metal cyanide

   Explanation: Cyanide forms soluble complex with the gold from which metal is obtained by replacement.

3. a. Iron

   Explanation: Iron is 2nd most abundant metal in earth's crust around 5 %.

4. b. SiO_2

   Explanation: Iron oxide is basic oxide so flux should be acidic.

   $FeO + SiO_2 \rightarrow FeSiO_3$ (slag)

5. a. All of these

   Explanation: SiO_2 is acidic so flux can be basic. Here remaining options are metallic oxides and hence basic in nature.

6. Oxygen.
7. Aluminium is reacted with iron oxide to give iron and aluminium oxide. It is known as thermite reaction. This reaction is highly exothermic and produces iron in molten state. It is used in welding of rails.

   $Fe_2O_3(s) + Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + heat$
8. Cryolite (Na_3AlF_6) has two roles in the metallurgy of aluminium:
   1. To decrease the melting point of the mixture from 2323 K to 1140 K.
   2. To increase the electrical conductivity of mixture.
9. Principal ores of zinc are:
   i. Zinc blende - (ZnS)
   ii. Calamine - ($ZnCO_3$)
   iii. Zincite - (ZnO)

10. 1. Cryolite (Na_3AlF_6) is added to alumina (Al_2O_3) to decrease the melting point of the mixture and to bring conductivity.
    2. In mond process, CO forms tetracarbonyl complex with nickel which is further decomposed at high temperature giving pure nickel metal.
11. **Uses:**
    i. Zinc is used for galvanizing iron.
    ii. Zinc dust is used as a reducing agent in the manufacture of dye-stuffs, paints, etc.
12. a. The nature of reducing agent to be used in a particular case depends on how difficult the reduction process is. If the metal is highly reactive, its chemical reduction is thermodynamically not possible. The reducing agent can reduce the metal oxide only if this is thermodynamically possible. Net ΔG for the two reactions must be -ve.
    b. i. Silicon can reduce MgO above 1966 K.
       ii. Aluminium can reduce above 1623 K.
       iii. Carbon cannot reduce MgO at any temperature.
13. i. Highly reactive metal (e.g. Na) occur in combined state as rock salt (NaCl)
    ii. Moderately reactive (e.g. Fe) occur in combined state as oxides (mainly)
    iii. Noble metal (e.g. Au) occur in free state.
14. **Calcination:** It is a process in which ore is heated in absence of air so as to remove volatile impurities. It is used to convert carbonate ore into oxide. It is also used to remove moisture and water of crystallization in hydrated ores e.g.

    $$Fe_2O_3 \cdot xH_2O \xrightarrow{heat} Fe_2O_3 + xH_2O$$

    $$ZnCO_3 \xrightarrow{heat} ZnO + CO_2$$

    Calamine

    $$FeCO_3 \xrightarrow{heat} FeO + CO_2$$

    Siderite

    $$CuCO \cdot Cu(OH)_2 \xrightarrow{heat} 2CuO + H_2O + CO_2$$

    Malachite

    $$MgCO_3 \cdot CaCO_3 \xrightarrow{heat} MgO + CaO + 2CO_2$$

    Dolomite

    Roasting: It is a process in which sulphide ore is heated in presence of oxygen so as to convert into oxide.

Sulphur dioxide

$2ZnS(s) + 3O_2\ (g) \longrightarrow 2ZnO(s) + 2SO_2(g)$

$2PbS(s) + 3O_2(g) \longrightarrow 2PbO(s) + 2SO2(g)$

$4FeS_2(s) + 11O_2(g) \longrightarrow 2Fe_2O_3(s) + 8SO_2(g)$

$2Cu_2S(s) + 3O_2(g) \longrightarrow 2Cu_2O(s) + 2SO_2(g)$

15. The standard Gibbs free energy of formation of ZnO from Zn (-600 kJ mol^{-1}) is lower than that of CO_2 from CO (-500 kJ mol^{-1}). Therefore, CO cannot reduce ZnO to Zn. Hence, Zn is not extracted from ZnO through reduction using CO.