

# Chemistry

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(Chapter 6)(General Principles and Processes of Isolation of Elements)

## XII

### Intext Questions

#### Question 6.1:

Which of the ores mentioned in Table 6.1 can be concentrated by magnetic separation method?

Answer

If the ore or the gangue can be attracted by the magnetic field, then the ore can be concentrated by the process of magnetic separation. Among the ores mentioned in table 6.1, the ores of iron such as haematite ( $\text{Fe}_2\text{O}_3$ ), magnetite ( $\text{Fe}_3\text{O}_4$ ), siderite ( $\text{FeCO}_3$ ), and iron pyrites ( $\text{FeS}_2$ ) can be separated by the process of magnetic separation.

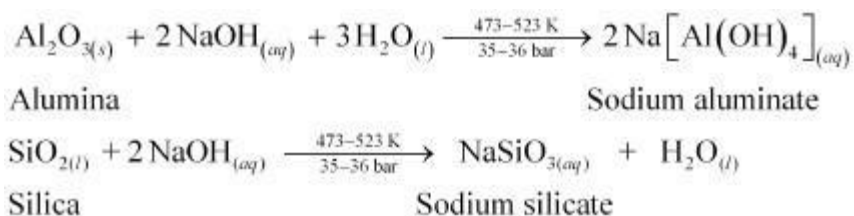
#### Question 6.2:

What is the significance of leaching in the extraction of aluminium?

Answer

In the extraction of aluminium, the significance of leaching is to concentrate pure alumina ( $\text{Al}_2\text{O}_3$ ) from bauxite ore.

Bauxite usually contains silica, iron oxide, and titanium oxide as impurities. In the process of leaching, alumina is concentrated by digesting the powdered ore with a concentrated solution of  $\text{NaOH}$  at 473-523 K and 35-36 bar. Under these conditions, alumina ( $\text{Al}_2\text{O}_3$ ) dissolves as sodium meta-aluminate and silica ( $\text{SiO}_2$ ) dissolves as sodium silicate leaving the impurities behind.



The impurities are then filtered and the solution is neutralized by passing  $\text{CO}_2$  gas. In this process, hydrated  $\text{Al}_2\text{O}_3$  gets precipitated and sodium silicate remains in the solution. Precipitation is induced by seeding the solution with freshly prepared samples



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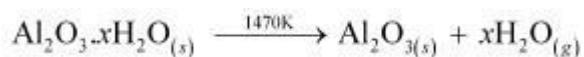
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of hydrated  $\text{Al}_2\text{O}_3$ .



Hydrated alumina

Hydrated alumina thus obtained is filtered, dried, and heated to give back pure alumina ( $\text{Al}_2\text{O}_3$ ).



### Question 6.3:

The reaction,



is thermodynamically feasible as is apparent from the Gibbs energy value.

Why does it not take place at room temperature?

Answer

The change in Gibbs energy is related to the equilibrium constant,  $K$  as

$$\Delta G = -RT \ln K$$

At room temperature, all reactants and products of the given reaction are in the solid state. As a result, equilibrium does not exist between the reactants and the products. Hence, the reaction does not take place at room temperature. However, at a higher temperature, chromium melts and the reaction takes place.

We also know that according to the equation

$$\Delta G = \Delta H - T\Delta S,$$

Increasing the temperature increases the value of  $T\Delta S$ , making the value of  $\Delta G$  more and more negative. Therefore, the reaction becomes more and more feasible as the temperature is increased.

### Question 6.4:

Is it true that under certain conditions, Mg can reduce  $\text{SiO}_2$  and Si can reduce  $\text{MgO}$ ?

What are those conditions?

Answer

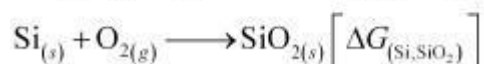
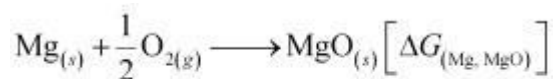


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The temperature range in which  $\Delta G_{(\text{Mg, MgO})}$  is lesser than  $\Delta G_{(\text{Si, SiO}_2)}$ , Mg can reduce  $\text{SiO}_2$  to Si.



On the other hand, the temperatures range in which  $\Delta G_{(\text{Si, SiO}_2)}$  is less than  $\Delta G_{(\text{Mg, MgO})}$ , Si can reduce  $\text{MgO}$  to Mg.



The temperature at which  $\Delta_r G$  curves of these two substances intersect is 1966 K. Thus, at temperatures less than 1966 K, Mg can reduce  $\text{SiO}_2$  and above 1966 K, Si can reduce  $\text{MgO}$ .