Answer on Question #57545 – Chemistry – General Chemistry

Question:

(I)Explain the processes which are used for the extraction of metals from carbonates and sulphide ores.

(II)Some metals such as Al, Au, Na can not be obtained from their ores by using common reducing agents such as C, CO, Water. Which type of reducing method is used for such metals?

Answer:

1) Chemical methods of extraction of metals include leaching of ores, i.e. extraction of the metal in any of its soluble salts from prepared for this purpose an aqueous solution. For example, for leaching of ores containing copper oxide(N), can be used diluted sulfuric acid. Processing of the ore it causes the reaction

$CuO(s) + 2H^+(aq) \rightarrow Cu^{2+}(aq) + H_2O(l)$

Reducing. Most metals exist in nature in the oxidized form. For example, the sodium exists in the form of ions Na*, included in compounds such as sodium chloride, and tin is in the form of SnO2 - the Second stage of extraction of metals consists in the reconstruction of their ores to the metallic state. To this end, different methods are used. The metals existing in nature in the form of oxide ores, can be restored without prior chemical treatment, using carbon or carbon monoxide. For example, in the smelting of iron from haematite ore in the blast furnace

$Fe_2O_3(s) + 3CO(g) \leftrightarrow 2Fe(l) + 3CO_2(g)$

This reaction is redox.

For the extraction of metals from carbonate and sulphide ores, they are first to be converted by heating into the corresponding oxides. For instance, production of zinc from zinc blende the ore is first calcined in air, resulting in reaction

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

The resulting oxide is then reduced by carbon or carbon monoxide, for example:

$ZnO(s) + CO(g) \rightarrow Zn(s) + CO_2(g)$

2) The metals belonging to the upper part of the range of voltages, usually recover by electrolysis of their molten ores. Among such metals are aluminum, magnesium and sodium. The electrolysis is carried out using inert electrodes, for example graphite. Metals recovered on the cathode in the form of liquid that accumulates at the bottom of the cell, where it can be let out. As an example, the equation for the half reaction occurring in the electrolytic obtaining of aluminum from aluminum chloride:

$Al^{3+}(l) + 2e^- \rightarrow Al(l) \rightarrow Al(s)$

Gold dissolves in solutions of hydrocyanic acid and its salts. Method of cyanidation is based on the reaction of gold with cyanide in the presence of air oxygen: the crushed gold-bearing rock is treated with dilute (0.3 to 0.03 per cent) solution of sodium cyanide, the gold from the resulting solution of sodium cyanoaurate $Na[Au(CN)_2]$ precipitates or zinc dust, or on a special ion exchange resins.

In addition, the gold can be extracted with a mercury in the form of amalgam