

General principles of isolation and extraction of elements

Value based Questions (Manjeet Singh KV Rajouri)

Q1. Ram visited the house of his friend Sham and found that all the water taps were rusted. On enquiry, he came to know that these were iron taps. Ram advised his friend to use either chrome plated or nickel plated taps. Sham accepted his advice.

(i) Why did iron top get rusted?

(ii) What is the purpose of chrome plating or nickel plating?

(iii) What is the name of the process?

(iv) What is the value associated with this?

Ans. (i) Iron is prone to rust. Articles made up of iron readily get rusted when kept in the open.

(ii) The purpose of depositing a layer of chromium or nickel on the surface of iron is to check rusting. These metals are not affected by air or moisture.

(iii) The process is known as electroplating.

(iv) Electroplating process is very useful both on small scale as well as on commercial scale. It is used for decoration as well as for preservation.

Q2. Metals are very useful in our daily life. Aluminium powder is used in white paints. It is also used as a reducing agent. Alloys containing Aluminium , being light, are very useful. Utensils of Aluminium are more popular than utensils of brass. Metals like silver, gold, iron, copper, zinc are very useful in our daily life:

(i) Which metal foils are used as wrappers for sweets, medicines, chapaties, etc.?

(ii) Why are Aluminium vessels preferred over copper and bronze vessels?

(iii) What value is associated for using Aluminium?

Ans. (i) Aluminium foils are used for this purpose.

(ii) Aluminium vessels are not affected either by acids or alkalies or by other chemicals. But copper and bronze vessels react with these forming poisonous chemical compounds. That is, why vessels made up of aluminium are preferred.

(iii) Aluminium is very useful metal. It is very light and good conductor of both heat and electricity. Although it is placed high up in the series but a layer of its oxide deposited on the surface of the metal checks its corrosion. That is why aluminium foils are so useful.

Q.3. In roasting, the ore is heated in a regular supply of air in a furnace at a temperature below the melting point of the metal. Metal sulphide gets converted into metal oxide and sulphur dioxide gas is formed which is air pollutant. It also leads to the formation of acid rain which is harmful for crops and buildings made from marble.

i) Where should we have industries using roasting process in metallurgy? Give reasons.

ii) How can we use sulphur dioxide gas?

iii) How can sulphuric acid help in national economy?

Ans i) The industries involving the roasting of sulphide ores must be installed at places far from the cities so that the pollution caused by the release of SO₂ gas may not affect human beings.

ii) Sulphur dioxide can be used as a bleaching agent for delicate articles, in refining of petroleum and sugar and also disinfectant for germs, fungi and mounds causing diseases.

iii) Sulphuric acid is one of the most useful industrial chemicals. It is used in storage batteries, in textiles, paper and leather industry, in the manufacture of paints and pigments.

Q.4 Many metals occur in the earth crust as sulphides. Usually these sulphide ores are concentrated by froth floatation process. But argentite which is the sulphide ore of silver is preferably concentrated by chemical process of leaching.

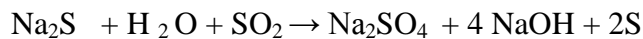
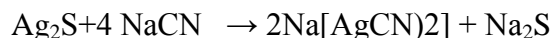
Now answer the following questions:

- (i) Explain why instead of froth floatation process.
- (ii) What reagent is used in the chemical leaching of argentite ore?
- (iii) How is silver extracted from the argentite ore?

Ans. (i) Froth floatation process is based upon the formation of rich and stable froth. Since argentite is a low grade ore. Therefore, it does not form a froth which can be easily separated from gangue.

(ii) the process of leaching involves treating the powdered ore with a suitable reagent which selectively dissolves the ore but not the ore particles. The reagent used for leaching of argentite ore is NaCN.

(iv) The ore is treated with a dilute solution of NaCN while a current of air is continuously passed. Silver dissolves forming a soluble complex while Na₂S formed in the reaction is oxidised to Na₂SO₄



The above solution containing the soluble complex is filtered to remove the insoluble impurity and the filtrate is treated with zinc to obtain silver.

Q.5. Iron is much abundant in the earth's crusts than aluminium. Both these metals are extensively used as structural. Over a period of time, Iron creates problems but aluminium does not. Now answer the following questions;

- (i) Give the one principal ore of each iron and aluminium.
- (ii) How is iron and aluminium obtained from their respective ores?
- (iii) What is the cause of the problem with iron but not with aluminium? How can this problem be overcome?

Ans. (i) The principal ore of iron is haematite (Fe_2O_3) while that of aluminium is bauxite (Al_2O_3).

- (ii) Iron is obtained by reduction of purified Fe_2O_3 with coke in a blast furnace while aluminium is obtained by electrolysis of fused purified Al_2O_3 to which cryolite (Na_2AlF_6) and fluorspar (CaF_2) have been added.
- (iii) When exposed to air, Al forms an impervious coat of Al_2O_3 which protects the metal from further corrosion. In contrast, iron forms iron rust ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$) which flakes off exposing fresh surface to corrosion. To overcome this problem, either stainless steel should be used instead of iron or iron structures should be protected from moisture and heat by painting.

Q.6. Carbon monoxide is used for refining of impure nickel in the Mond's process. But carbon monoxide is highly poisonous gas inhalation of which causes death.

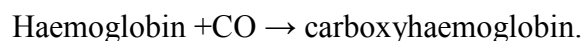
Now answer the following questions:

- (i) What is the principle of Mond's process for refining of nickel?
- (ii) How does carbon monoxide poisoning cause death?

- (iii) Should Mond's process for refining of nickel be banned because carbon monoxide not only pollutes the environment but its accidental leakage from the plants may prove fatal for workers in the factory?

Ans. (i) When impure nickel is heated in a current of CO at 330-3350 K, it forms volatile nickel tetracarbonyl complex leaving behind the impurities. The complex thus obtained is heated to a higher temperature (450-470 K) when it undergoes decomposition giving pure nickel and regaining CO.

- (ii) Carbon monoxide is highly poisonous. It combines with haemoglobin of blood to form carboxyhaemoglobin.



Which is about 3000 times more stable than carboxyhaemoglobin complex which it forms with oxygen .

Haemoglobin + 2O → Oxyhaemoglobin.

This prevents haemoglobin present in the red blood cells from carrying oxygen from the lungs to all part of the body causing suffocation ultimately leading to death.

- (iii) Although CO is an environmental pollutant and a threat to the life of workers in the factories, but it being very cheap it keeps the cost of pure nickel low which is extensively used in nickel plating and other articles of daily use, Therefore, Mond's process cannot be banned if we have to keep the pure nickel metal cheap to meet the requirements of industry. Instead, better safety arrangements should be made for the workers in the factory. Further, if the cost of electricity is reduced, electrolytic method for refining of impure nickel metal can be used.