

7.5 SILVER

Learning outcomes

- Describe the Occurrence of silver
- Describe the extraction of silver by the cyanide process
- Explain the preparation and uses of silver chloride and silver nitrate

Symbol: Ag

Atomic number: 47

Atomic weight: 107.9 amu

Electronic configuration: [Kr] $4d^{10}5s^1$

Occurrence

Occurs in native as well as combined states. The main producers of Ag metal are Mexico, the USA, Peru, Canada, Australia, Russia, and Chile.

The common ores of silver are

Argentite or silver glance, Ag_2S

Horn silver, AgCl

Ruby silver, Ag_2SbS_3

Argentiferous galena (PbS), which contains 0.01-0.1% Ag

Extraction of Silver by the cyanide process

Crushing and Pulverization: Big lumps of ore are crushed with the help of a jaw crusher, and finally crushed ore is powdered by using a Ball mill.

Concentration: The crushed ore is then mixed with water and a little pine oil in a tank. It is then agitated by blowing compressed air. The ore along with the froth comes on the surface of the water. The impurities settle at the bottom of the tank. The froth is skimmed off.

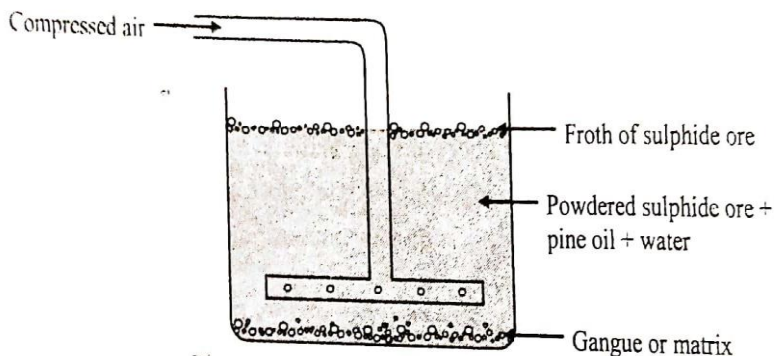
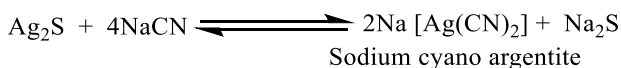
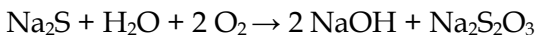
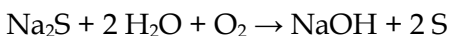


Figure 18.6: Froth Flotation process

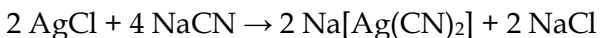
Formation of Complex Cyanides: Concentrated ore is then agitated with NaCN solution using air. As a result of the reaction, sodium argento-cyanide is obtained.



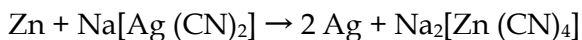
As the reaction is reversible, the air is blown to remove Na_2S as $\text{Na}_2\text{S}_2\text{O}_3$ and S so that the reaction does not occur in the backward direction.



The same procedure can be applied to Horn Silver (AgCl)



Precipitation of silver: The solution is then filtered and treated with zinc metal. Zinc, being more electropositive, displaces silver from the solution.



Spongy silver

The precipitated silver is removed by filtration and dried.

Refining: The dried silver is heated with KNO_3 in a crucible. The impurities in the silver get oxidized on the surface, and the liquid silver

forms a compact mass on cooling. After that, impure silver is purified by the electrolytic method.

In this process, the anode is made up of impure Ag and the cathode is made up of pure silver. Here, 6% AgNO_3 solution with 1% HNO_3 is used as an electrolytic solution. When an electric current is passed, impure silver from the anode dissolves, and pure silver is deposited on the cathode. Other impurities settle down as anode mud.

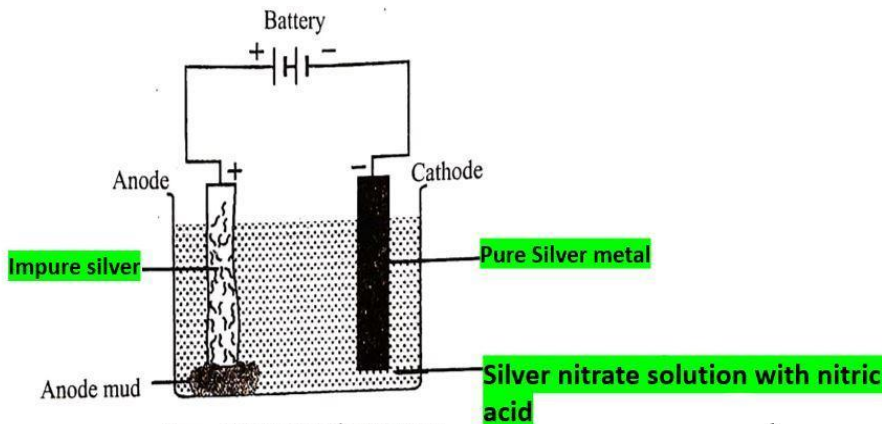


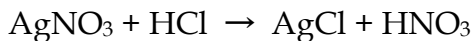
Figure 18.8: Electrorefining process.

1. What is meant by spongy silver? 2
2. Give various steps involved in the extraction of silver from the silver glance. 5
3. Why are silver ores leached with metal cyanides for the extraction of silver? 2

Silver chloride

Preparation

By adding any soluble chloride to silver nitrate



The ppt. is separated by filtration, washed, and dried at around 70°C .

Uses of Silver Chloride

Silver halides are sensitive to light, so they are used in photography.

AgCl is used for making photographic paper.

Silver nitrate

Preparation

By dissolving the silver metal in 1:1 nitric acid and evaporating the resulting solution to the crystallization point.



It is obtained in the form of crystals or sticks and is known as **lunar caustic** because when it comes in contact with skin or clothes, it produces a burning sensation like caustic and gets reduced to Ag, which is white like the moon.

Uses of Silver Nitrate

- as a dental antiseptic
- laboratory reagent in volumetric analysis for the estimation of chlorides, bromides, cyanides, and thiocyanates.
- in medicine, photography, and electro-refining.
- manufacture of hair dyes and indelible inks (voter's ink).
- preparation of various compounds of silver, like Tollens' reagent.
- In qualitative analysis to detect Cl⁻, Br⁻, I⁻, CN⁻, S²⁻, C₂O₄²⁻, CrO₄²⁻ etc.

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| 4. Give an important use of silver nitrate. | 0.5 |
| 5. Give two uses of silver nitrate. | 2 |

1. Which one is Ruby silver?
a. Ag₂S b. Ag₂C c. AgCl d. AgSbS₃
2. Lunar Caustic is
a. AgNO₃ b. AgCl c. Ag₂C d. AgNO₃+AgCl
3. Silver is extracted from its sulphide ore by
a. Contact process c. down's process
b. Cyanide process d. ostwald's process

4. Which of the following metal is extracted by the cyanide process?
a. Ag b. Na c. Al d. Cu
5. In the electrolytic refining of silver, the anode mud obtained contains
a. Zn, Ag & Au b. Cu, Ag & Au c. **Au** d. Cu, Zn, Ag & Au
6. Which of the following compound is used for silvering a mirror?
a. AgCl b. AgNO₃ c. AgBr d. AgS

*****This is not a complete note. It is to guide you. It is recommended to study the prescribed textbooks along with this material. *****