

Mercury

Symbol : Hg

Latin name : Hydrargyrum

Atomic number : 80

Atomic mass : 200.59

Valency : 1,2

Occurance

some important ores of mercury are

- ***Cinnabar (HgS)***
- *Tremannite (HgSe)*
- *calomel (Hg₂Cl₂)*
- *in nepal it is found in Tirche pani*

Note: Hg is only metal which is liquid at room temperature

Extraction of mercury from cinnabar

1. Crushing and pulverization

Big lumps of ores are crushed using jaw crushers to get crushed ore which is pulverized using a pulverizer or stamp mill to get powdered ore.

2. Concentration by froth floatation process

The powdered ore is taken in a tank containing water and a small amount of pine oil. The mixture is heated by the blast of air. Impurities are wetted by water and get collected at the bottom of the tank. Ore particles are wetted by oil and come to the surface as froth. The froth is skimmed off to collect concentrated ore.

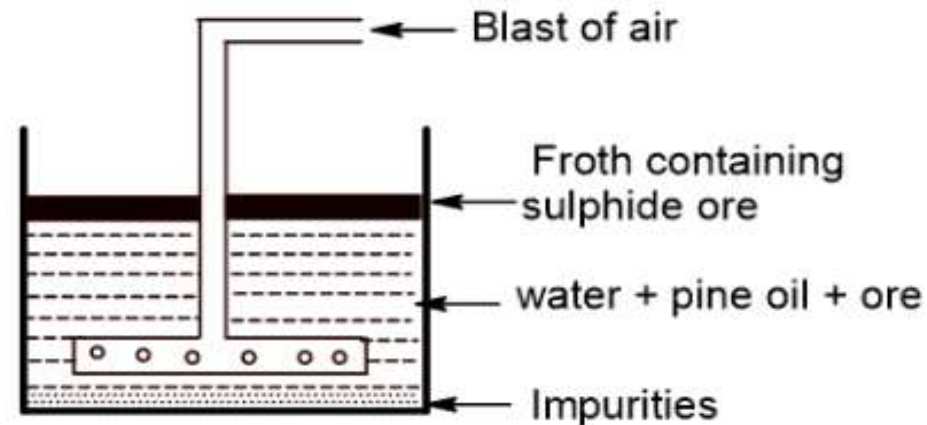
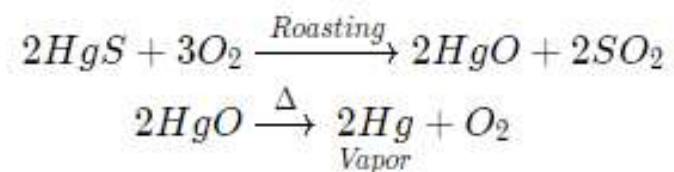


Fig: Froth Floatation Process

3. Roasting and distillation in shaft furnace

The shaft furnace is a long cylindrical body having a cup and cone arrangement. This arrangement allows the charge (ore + coke +lime) to enter through the furnace but prevents mercury vapour from escaping. The shaft furnace contains a Y-shaped side tube that is passed through the cooler. The concentrated ore, coke and lime are mixed together and fed through cup and cone arrangement. The furnace is heated by the supply of air till it becomes red hot. In doing so, mercuric sulphide gets oxidized to mercuric oxide which decomposes into mercury.



Mercury vapour is passed to water-cooled Y-shaped tubes. These vapour gets condensed to give liquid mercury. The spent ore is taken out from the bottom of the furnace. The waste gas escapes out through the outlet of the condenser.

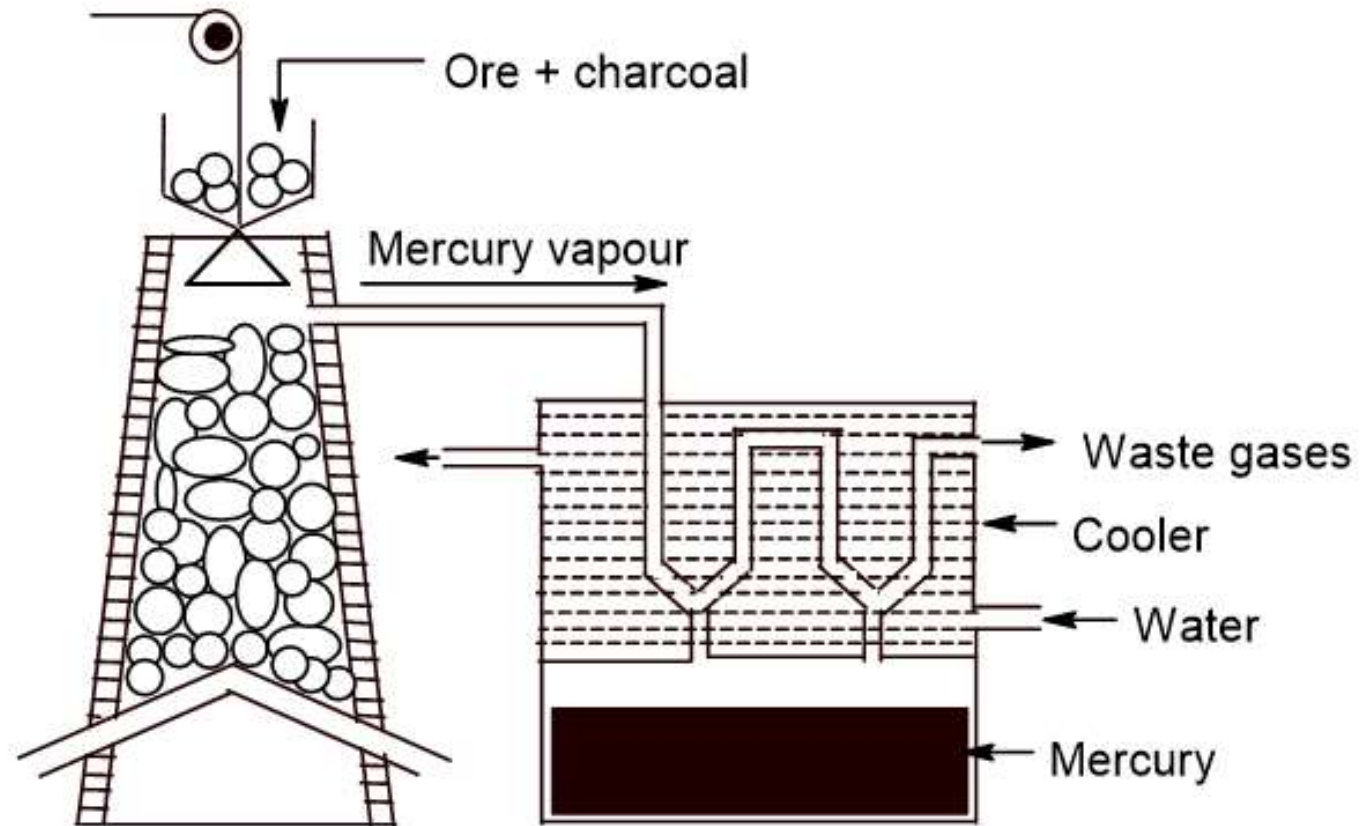


Fig: Shaft furnace

4. Purification

- Filtration: Mercury is filtered through chamois leather where suspended oxide impurities are removed.
- Treatment with 5% nitric acid: Filtered mercury is passed through a long tube containing 5% nitric acid.

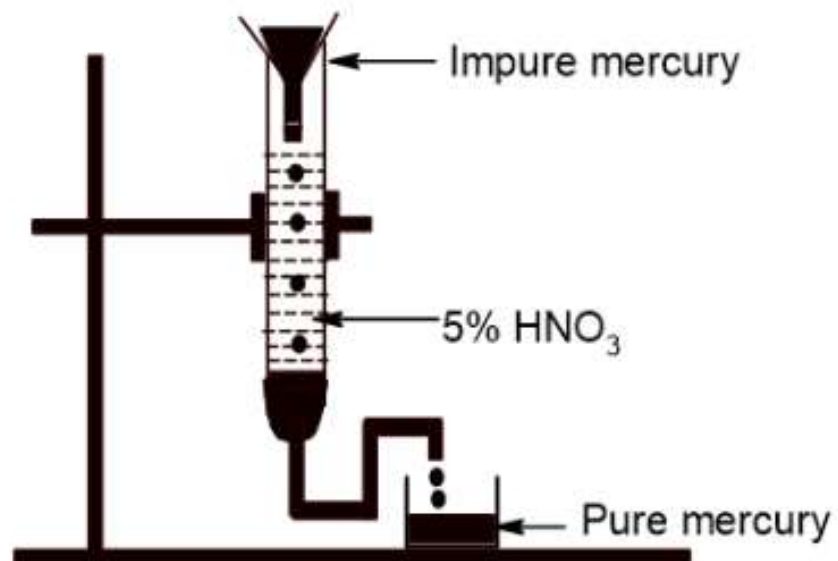
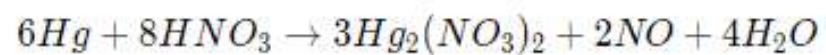


Fig: Purification of mercury

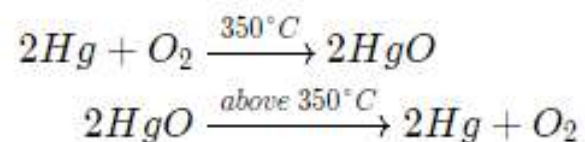
iii. Vacuum distillation: Mercury obtained from the above process still contains impurities like Ag, Au, etc. which is subjected to distillation under reduced pressure. Mercury gets distilled leaving behind the impurities.

Physical properties

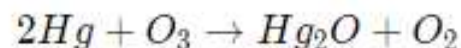
1. It is silvery-white liquid metal. It is also called quicksilver.
2. It is the heaviest liquid known.
3. It melts at -39°C and boils at 357°C .
4. It is a good conductor of heat and electricity.
5. Its vapour is highly poisonous.
6. It dissolves in many metals (except Fe and Pt) to form an amalgam. So, it is stored in iron vessels.

Chemical properties

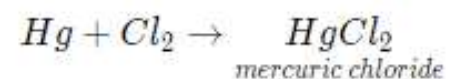
1. Action with air: Mercury does not react with dry or moist air in ordinary conditions. When it is heated up to 350°C in the air, it slowly gets oxidized to mercuric oxide which decomposes on further heating.



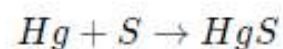
2. Action with ozone: When mercury comes in contact with ozone, it is oxidized to mercurous oxide (Hg₂O), so that mercury loses its meniscus shape and leaves a black mark (like a tail) on the glass. This special property of mercury is called the tailing of mercury.



3. Action with halogens: Hot mercury combines with halogens to give respective halides.

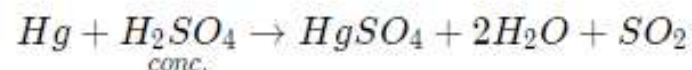


4. Action with sulphur: When mercury is warmed with sulphur, a black mass of mercuric sulphide is formed.

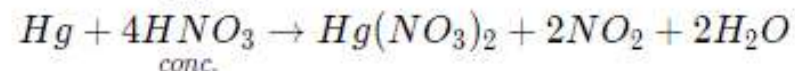
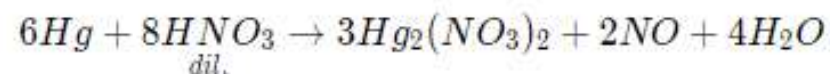


5. Action with acids

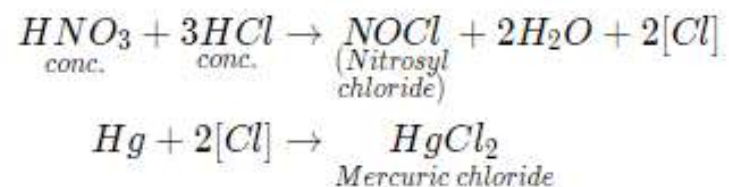
- It doesn't react with dilute and conc. HCl.
- It does not react with dil. H_2SO_4 but reacts with hot and conc. H_2SO_4 .



- Action with HNO_3

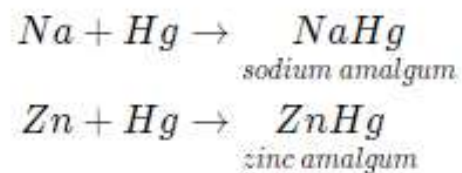


6. Action with aqua-regia: Mercury reacts with aqua-regia (mixture of conc. HNO₃ and conc. HCl in the ratio of 1:3) to form mercuric chloride.



*Aqua regia is also called kingly water or royal water.

7. Action with metals: Almost all metals except Fe and Pt dissolve in mercury and form amalgams.



These amalgams are used as reducing agents.

Uses of mercury

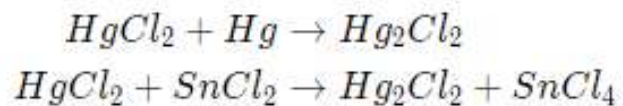
- In the manufacture of caustic soda
- In the metallurgy of gold and silver.
- In mercury vapour lamps.
- In making dental plastic.
- It is used in silvering mirror.

Compounds of mercury

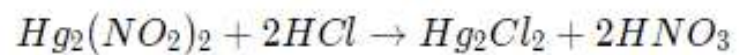
A. Calomel or mercurous chloride: Hg_2Cl_2

Preparation

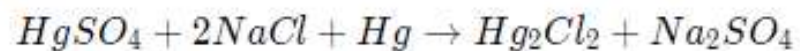
i. From mercuric chloride



ii. From mercurous nitrate



iii. From mercuric sulphate

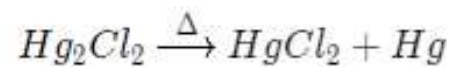


Physical properties

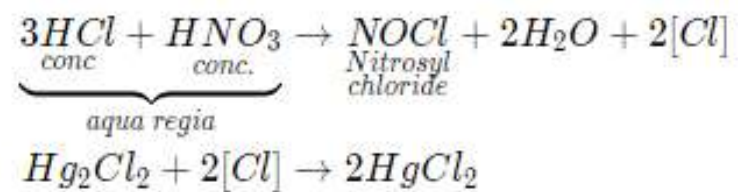
- It is a white powder.
- It is insoluble in water.
- It sublimes above 350°C.

Chemical properties

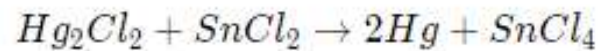
i. Action of heat



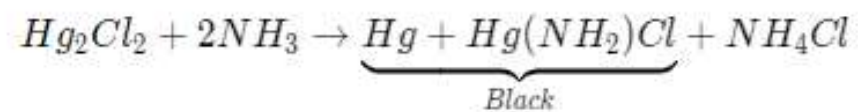
ii. Action with aqua regia



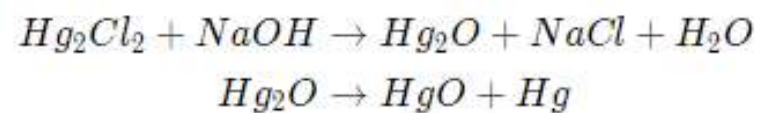
iii. Action with stannous chloride



iv. Action with ammonia



v. Action with NaOH



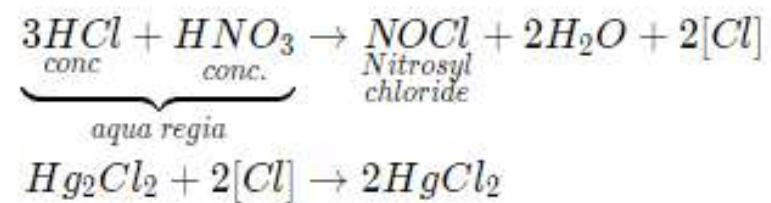
Uses

- As a purgative drug.
- To make electrodes.
- As fungicides.

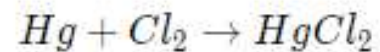
B. Corrosive sublimate or mercuric chloride: HgCl_2

Preparation

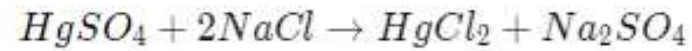
i. By the action of calomel and aqua regia



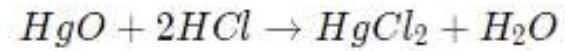
ii. From mercury



iii. From mercuric sulphate



iv. From mercuric oxide



Physical properties

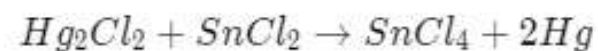
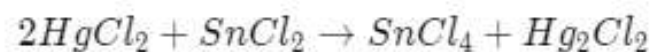
- It is a white crystalline solid.
- it is soluble in hot water.
- It is poisonous.

Chemical properties

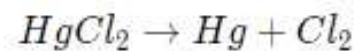
i. Action of NaOH



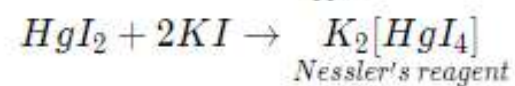
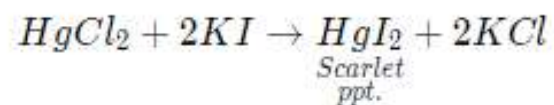
ii. Action with SnCl₂



iii. Action of heat



iv. Action with KI



Uses

- As fungicides.
- In preparation for Nessler's reagent and calomel.
- As an antidote (medicine against poison).
- As skin and wood preservative.

Multiple Choice Questions:

1. If a filter paper soaked by Hg^{++} ions is exposed in a gas jar containing NH_3 the filter paper will turn.....
a) Black b) Red c) Brown d) Blue
2. Tailing of mercury is due to the formation of
a) HgO b) Hg_2O c) HgO_2 d) Hg_2O_2
3. Cinnabar is an ore of:
a) Hg b) Cu c) Pb d) Zn
4. Molecular formula of corrosive sublimate is
a) HgCl_2 b) Hg_2Cl_2 c) HgCl d) NaCl
5. Calomel is:
a) HgCl_2 b) Hg_2Cl_2 c) $\text{Hg} + \text{HgCl}_2$ d) Hg_2Cl_2 and Hg
6. Which is used as purgative in medicine?
a) ZnCl_2 b) HgCl_2 c) Hg_2Cl_2 d) $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

Short Answer Questions:

1. A metal (M) is extracted from its sulphide ore whose atomic number is 80. It also occurs as the amalgams of certain metals and is popularly known as quick silver.
 - a) Name the metal “M” and write down the molecular formula of its common ore.
 - b) Why is this metal called quick silver?
 - c) State the process by which the ore is concentrated during its extraction.
 - d) Write down the chemical reaction involved during reduction in its extraction.
 - e) Mention a major use of the metal.

2. Calomel has molecular formula Hg_2Cl_2 .
 - a) Why does it exist in dimeric (Hg_2Cl_2) form?
 - b) Write its action with aqua regia.
 - c) Mention its one medicinal use.
 - d) when Hg_2Cl_2 is oxidized, it forms HgCl_2 called corrosive sublimate. Why is it called so?
 - e) Write the action of HgCl_2 with excess KI solution? Name the product formed. For which purpose the Product is used?

3. Mercury (commonly called Paro) is a only liquid metal at room temperature.
 - a) What is the reason for its liquid state?
 - b) Mention the formula of its important ore.
 - c) Draw the shaft furnace used for the roasting and distillation of ore of mercury. Also mention the reaction involved in the process.
 - d) Hg is purified by treating it with dil. HNO_3 . Write the reason and reaction involved for this.
 - e) Why is Hg transported in Fe containers? Can it be carried in zinc (Zn) vessel?