

SUBJECT - CHEMISTRY

CLASS - BSc(Hons) PART-II

PAPER - III

GROUP - B

TOPIC - CHEMISTRY OF COBALT (Co)

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Important ores of Co: Co occurs in nature much less abundantly than iron. It constitutes about 0.002 percent of the earth's crust. Cobalt occurs in combination with arsenic. The chief ores are,

(1) Smaltite, $(CoAs_2)$

(2) Cobaltite $(CoAsS)$

(3) Cobalt bloom $Co_3(AsO_4)_2 \cdot 8H_2O$ and

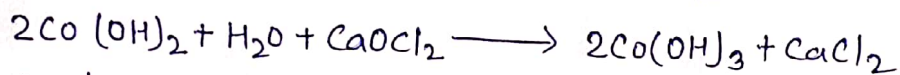
(4) Linnacite Co_3S_4 .

Extraction: The extraction of Co from its ores involves the following steps -

- (1) Roasting and Smelting of the ore: The ore is finally powdered and then roasted when most of the sulphur and As are volatilised off. It is then mixed with limestone and sand and smelted in a small blast furnace. The iron present in the ore rises above as ferrous silicate slag. The rest of the metals separated into two layers, the upper layer known as speiss consisting mainly of arsenides of nickel, cobalt, iron and Cu and the lower layer consisting of impure silver.
- (2) Roasting the speiss with NaCl: The speiss is separated, ground and roasted with NaCl in a reverberatory furnace. Most of the arsenic and S are driven off while the metals are converted into their chlorides.
- (3) Separation of iron and Cu: The roasted mass is extracted with H_2O and some lime stone is added to precipitate iron, arsenic and antimony. Cu that goes into the filtrate is removed by adding Na_2CO_3 , while cobalt and nickel remains in solution as chlorides. Ag, if present, is extracted by cyanide process.

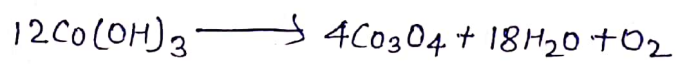
(4) Separation of Fe and Cu: The roasted mass is extracted with H_2O and some lime stone is added to precipitate iron arsenic and antimony. Cu that goes into the filtrate is removed by adding Na_2CO_3 while Co and Ni remain in solution as chloride. Ag, if present is extracted by cyanide process.

(5) Separation of Ni from Co: Co is precipitated out as Cobalt(II) hydroxide, almost free from Ni, from the solution of chlorides of Cobalt and Ni on addition of lime and bleaching powder.

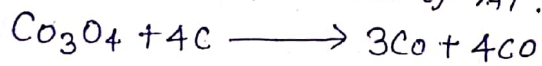


Nickel that remains in solution can be precipitated as basic carbonates on the addition of Na_2CO_3 .

The Cobalt(II) hydroxide is ignited to give Cobalt(II)-Cobalt(III) oxide Co_3O_4

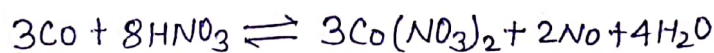
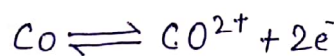


(6) Reduction of the Co(II)-Co(III) oxide: The Co(II)Co(III) oxide is reduced to the metal Cobalt either by heating with C and lime stone in an electric furnace or by means of Al.



Chemical properties:

(1) Reaction with acid



(2) It is rendered passive on treatment with conc. HNO_3

(3) It is less active reducing agent than Fe

(4) It reacts with atmospheric O_2 only when heating giving the Cobalt oxide:

Uses:

- (1) Compounds of Cobalt are used as pigments in glass and porcelain.
- (2) Co is also used in making some useful alloys.
- (3) Co is also used for electroplating iron and other base metals.