Nitric Acid

- Molecular formula : ~~At~~ HNO_3
- ~~Mo~~

→ Nitric acid is known as aqua fortis meaning 'strong water.

It is so called because it reacts with nearly all metals and converts them to soluble nitrates.

LABORATORY PREPARATION OF HNO_3

→ Reactants: • Potassium nitrate (KNO_3)
• Conc. Sulphuric Acid

→ Reaction:

$$KNO_3 + \underset{(conc.)}{H_2SO_4} \xrightarrow{<200°C} KHSO_4 + HNO_3$$

$$NaNO_3 + \underset{(conc.)}{H_2SO_4} \xrightarrow{<200°C} NaHSO_4 + HNO_3$$

→ Collection: The vapours of nitric acid condenses to a light yellow liquid by chilling the receiver with cold water.

NOTE: Pure HNO_3 acid is colourless but the acid obtained in lab is slightly yellow. The yellow colour is due to dissolution of reddish brown coloured nitrogen dioxide gas in the acid

$$4HNO_3 \longrightarrow 2H_2O + 4NO_2 + O_2$$

-> How to remove the yellow colour of the acid?

-> by passing dry air or CO_2 through the yellow acid. It drives out NO_2 from warm acid which is further oxidised to Nitric acid.

-> By adding excess of water.

Precautions:

i) All glass apparatus is used because HNO_3 vapours attacks rubber and cork.

ii) Conc. HCl is not used because it is volatile

iii) The temperature of reaction should not excess 200°C, because sodium sulphate forms a hard crust which sticks to the wall of the retort and is difficult to remove.

MANUFACTURE OF NITRIC ACID

PROCESS: Ostwald Process

Step I: Catalytic oxidation of ammonia

- Mixture of dry air and dry ammonia in the ratio of 10:1 by volume

→ $4NH_3 + 5O_2 \xrightarrow[800°C]{Pt} 4NO + 6H_2O + Heat$

exothermic reaction

Step II:

$2NO + O_2 \xrightarrow{50°C} 2NO_2$

Step III : Absorption of NO_2 in water

$$4NO_2 + 2H_2O + O_2 \longrightarrow 4HNO_3$$

- The acid obtained is concentrated above 50%.
- On further distillation gives 68% nitric acid

⇒ Flowchart for Ostwald Process