DUMA'S METHOD

This method can be applied to all nitrogenous compounds. Though tedious better than Kjeldahl's method.

$$C_xH_yN_z \xrightarrow[CO_2]{CuO} x.CO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + traces\ of\ oxides\ of\ Nitrogen \xrightarrow{Cu}$$

$$4Cu + 2NO_2 \rightarrow 4CuO + N_2$$

$$2Cu + 2NO \rightarrow 2CuO + N_2$$

$$Cu + N_2O \rightarrow CuO + N_2$$

The mixture of gases is passed in KOH all gases except N_2 are absorbed. Nitrogen is collected over KOH and its volume at NTP is measured.

$$Percentage\ of\ \ Nitrogen = \frac{28 \times volume\ of\ \ N_2\ \ at\ \ NTP \times 100}{22400 \times wt.\ of\ \ organic\ \ compound}$$

$$= \frac{wt\ \ of\ \ nitrogen \times 100}{wt.\ of\ \ organic\ \text{substance}}$$

KJELDAHL'S METHOD

Organic compound $+\text{Conc } H_2SO_4 + (\text{small amount of } K_2SO_4 \text{ and } CuSO_4 \text{ or } Hg) \rightarrow (NH_4)_2SO_4 \xrightarrow{2NaOH} Na_2SO_4 + 2NH_3 + 2H_2O$

Ammonia is passed into H_2SO_4 or HCl of known volume and normality. The volume of acid neutralised by NH_3 is calculated by neutralising the acid left by NaOH solution.

$$\text{Percentage of Nitrogen} = \frac{1.4 \times N \times V}{wt.\ of\ organic\ compound}$$

N = normality of acid, V = volume of acid in ml. neutralised by ammonia

In practice K_2SO_4 is added to raise the bpt of H_2SO_4 and $CuSO_4$ or Hg is added to catalyse the reaction)

Kjeldahl's method is not reliable. The results obtained are generally low. It cannot be applied to compounds in which nitrogen is directly linked to oxygen such as nitro, nitroso, azo and nitrogen present as in pyridine. It is used for estimating nitrogen in food , fertilizers and agricultural products.

CARIUS METHOD

Organic compound + Fuming HNO_3 + $AgNO_3$ $\rightarrow$ AgX.

It is estimated gravimetrically

$$Percentage\ of\ \text{halogen} = \frac{wt.\ of\ \text{halogen}\ atom \times wt.\ of\ AgX \times 100}{Mol.\ wt.\ of\ AgX \times wt.\ of\ organic\ compound}$$