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Concentration terms

(30)

$$CO_2(g) + C(s) \longrightarrow 2CO(g)$$

$1-x$ $\qquad$ $2x$

$$1 + x = 1.4$$

$$x = 0.4$$

0.6 $\qquad$ 0.8

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$$2A(g) + 5B(g) \longrightarrow C(g) + 2D(g)$$

2 ml	5 ml	1 ml	2 mol

V.C = 7 - 3
= 4 ml

10 ml	20 ml		
2 ml	0	$\frac{1}{5} \times 20$	$\frac{2}{5} \times 20$
		4 ml	8 ml

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Concentration terms

(32)

$$C_xH_y + \left(x + \frac{y}{4}\right) O_2 \longrightarrow x\,CO_2 + \frac{y}{2} H_2O(\ell)$$

V ml	$V\left(x + \frac{y}{4}\right)$	Vx	X
$=1$			

$$V\left(x + \frac{y}{4}\right) = 6V$$

$$y = 8$$

$$Vx = 4V$$

$$x = 4$$

Comprehension 17 and 18 (2 questions)

Estimation of halogens : C_2H_5Br

Carius method : A known mass of compound is heated with conc. HNO_3 in the presence of $AgNO_3$ contained in a hard glass tube known as Carius tube in a furnace. C and H are oxidised to CO_2 and H_2O. The halogen forms the corresponding AgX. It is filtered, dried, and weighed.

AgBr

Estimation of sulphur : A known mass of compound is heated with fuming HNO_3 or sodium peroxide (Na_2O_2) in the presence of $BaCl_2$ solution in Carius tube. Sulphur is oxidised to H_2SO_4 and precipitated as $BaSO_4$. It is filtered, dried and weighed.

17. 0.15gm of an organic compound gave 0.12 gm of silver bromide by the Carius method. Find the percentage of bromine in the compound.

(A) 34.0 (B) 40 (C) 17 (D) 68

$\frac{0.12}{188} \times 80$

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Carius method

$$\text{compound} + \overset{\text{conc}}{HNO_3} + AgNO_3 \longrightarrow AgX\ (ppt)$$

for sulphur

$$\text{compound} + \overset{HNO_3 \text{ or } Na_2O_2}{} + BaCl_2 \longrightarrow BaSO_4\ (ppt)$$

Comprehension 17 and 18 (2 questions)

Estimation of halogens :

Carius method : A known mass of compound is heated with conc. HNO_3 in the presence of $AgNO_3$ contained in a hard glass tube known as Carius tube in a furnace. C and H are oxidised to CO_2 and H_2O. The halogen forms the corresponding AgX. It is filtered, dried, and weighed.

Estimation of sulphur : A known mass of compound is heated with fuming HNO_3 or sodium peroxide (Na_2O_2) in the presence of $BaCl_2$ solution in Carius tube. Sulphur is oxidised to H_2SO_4 and precipitated as $BaSO_4$. It is filtered, dried and weighed.

18. 0.2595 gm of an organic substance when treated by Carius method gave 0.35gm of $BaSO_4$. Calculate the percentage of sulphur in the compound.

(A) 9 (B) 30.4 (C) 18.52 (D) 40.52

Comprehension 19 and 20 (2 questions)

Estimation of phosphorous :

A known mass of compound is heated with fuming HNO_3 or sodium peroxide (Na_2O_2) in Carius tube which converts phosphorous to H_3PO_4. Magnesia mixture ($MgCl_2 + NH_4Cl$) is then added, which gives the precipitate of magnesium ammonium phosphate ($MgNH_4.PO_4$) which on heating gives magnesium pyrophosphate ($Mg_2P_2O_7$), which is weighed.

19. 0.12 gm of an organic compound containing phosphorus gave 0.22 gm of $Mg_2P_2O_7$ by the usual analysis. Calculate the percentage of phosphorous in the compound.

(A) 25 (B) 9.25 (C) 80.1 (D) 51.20

$$\frac{\frac{0.22}{222} \times 2 \times 31}{0.12} \times 100$$

Comprehension 19 and 20 (2 questions)

Estimation of phosphorous :

A known mass of compound is heated with fuming HNO_3 or sodium peroxide (Na_2O_2) in Carius tube which converts phosphorous to H_3PO_4. Magnesia mixture ($MgCl_2 + NH_4Cl$) is then added, which gives the precipitate of magnesium ammonium phosphate ($MgNH_4.PO_4$) which on heating gives magnesium pyrophosphate ($Mg_2P_2O_7$), which is weighed.

20. n organic compound has 6.2% of phosphorus. On sequence of reaction the phosphorous present in the 10gm of organic compound is converted to $Mg_2P_2O_7$. Find wt. of $Mg_2P_2O_7$ formed.

(A) 2.22 (B)10.2 (C) 15 (D) 20

Comprehension 21 and 24 (4 questions)

Estimation of nitrogen : There are two methods for the estimation of nitrogen (i) Dumas method and (ii) Kjeldahl's method.

Duma's method : A known mass of compound is heated with copper oxide (CuO) in an atmosphere of CO_2, which gives free nitrogen along with CO_2 and H_2O.

$C_xH_yN_z + (2x + y/2)\ CuO \rightarrow xCO_2 + y/2\ (H_2O) + z/2\ (N_2) + (2x + y/2)\ Cu.$

The gaseous mixture is passed over a heated copper gauze which converts traces of nitrogen oxides formed to N_2. The gaseous mixture is collected over an aqueous solution of KOH which absorbs CO_2, and nitrogen is collected in the upper part of the graduated tube.

ii. Kjeldahl's method : A known mass of organic compound (0.5 gm) is mixed with K_2SO_4 (10 gm) and $CuSO_4$. (1.0 gm) or a drop of mercury (Hg) and conc. H_2SO_4 (25 ml) , and heated in Kjeldahl's flask. $CuSO_4$ or Hg acts as a catalyst, while K_2SO_4 raises the boiling point of H_2SO_4. The nitrogen in the organic compound is quantitatively converted to ammonium sulphate. The resulting mixture is then distilled with excess of NaOH solution and the NH_3 evolved is passed into a known but excess volume of standard HCl or H_2SO_4. The acid left unused is estimated by titration with some standard alkali. The amount of acid used against NH_3 can thus be known and from this the percentage of nitrogen is calculated.

(a) $C + H + S \xrightarrow[H_2SO_4]{conc} CO_2 + H_2O + SO_2$

(b) $N \xrightarrow[N_2SO_4]{conc} (NH_4)_2SO_4$

(c) $(NH_4)_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2NH_3 + 2H_2O$

(d) $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

iii. This method is not applicable to compounds containing N in nitro and azo groups, and N present in the ring (e.g.. pyridine) as N of these compounds does not change to $(NH_4)_2SO_4$ (ammonium sulphate) under these reaction conditions.

21. 0.30 gm of an organic compound gave 50 ml of nitrogen collected at 300K and 715 mm pressure in Duma's method. Calculate the percentage of nitrogen in the compound.

$P_{N_2} = 715 - 15 = 700\ mm\ of\ Hg$

(Vapour pressure of water or aqueous tension of water at 300K is 15 mm.

(A) 10.2 (B) 17.46 (C) 24 (D) 34

22. 0.50 gm of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 ml of 0.5M H_2SO_4. The residual acid required 60 ml of M/2 NaOH solution. Find the percentage of nitrogen in the compound.

(A) 50 (B) 56.0 (C) 66 (D) 40

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

20 mmol | 10 mmol

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

30 mmol | 15 mmol

moles of $N = \frac{20}{1000}$

$\%N = \frac{20/1000 \times 14}{0.5} \times 100$

Total mmoles of $H_2SO_4 = 25$

mmoles of $NaOH = 30$ mmol

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$$\frac{700}{760} \times \frac{50}{1000} = n \times R \times 300$$

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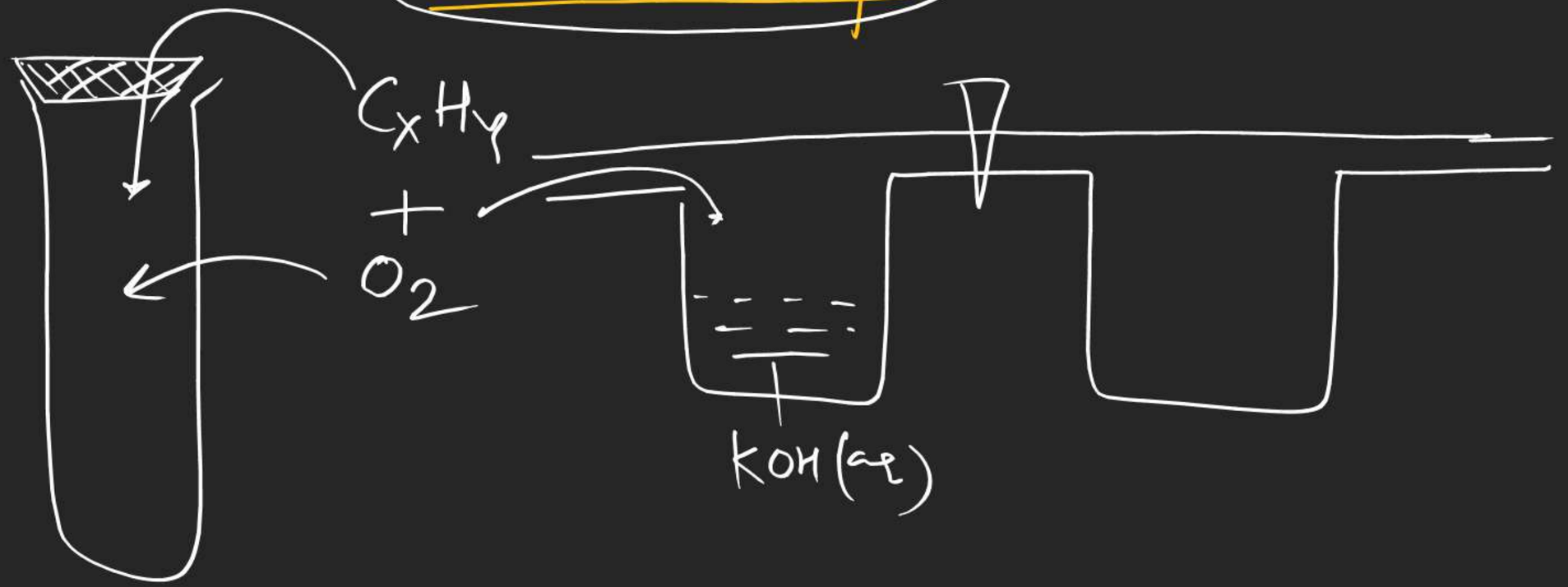
Eudiometry



Eudiometry tube

Gas	gas absorbed by
CO_2, SO_2, Cl_2	KOH(aq)
O_2	Alkaline pyrogallol
O_3	Turpentine oil
$H_2O(g)$	anhydrous $CaCl_2$, Silica gel
$HCl(g)$, $NH_3(g)$	$H_2O(l)$

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$C \longrightarrow CO_2(g)$

$H \longrightarrow H_2O(l \text{ or } g)$

$S \longrightarrow SO_2(g)$

$N \longrightarrow N_2(g)$

O_2 is always added in excess amount

$< 100^\circ C$

$> 100^\circ C$

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20ml gaseous hydrocarbon is mixed with 100 ml O_2 in an endiometry tube. After sparking, resultant gases occupy 80ml volume reduces to 20 ml when it is passed through KOH sol^n. find formula of H.C.

$$C_xH_y(g) + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O(\ell)$$

20ml $\quad 20\left(x+\frac{y}{4}\right) \quad 20x$

Remaining O_2

$100 - 20\left(x+\frac{y}{4}\right)$

~~$20\left(x+\frac{y}{4}\right) = 80$~~ 4

$$100 - 20\left(x+\frac{y}{4}\right) + 20x = 80$$

$20x = 60$

$x = 3$

$y = 4$

$$C_x H_y O_z + a\,O_2 \longrightarrow x\,CO_2(g) + \tfrac{y}{2} H_2O(\ell)$$

$$z + 2a = 2x + \tfrac{y}{2}$$

$$a = \left(x + \tfrac{y}{4} - \tfrac{z}{2}\right)$$

$$C_x H_y N_z + \left(x + \tfrac{y}{4}\right) O_2 \longrightarrow x\,CO_2 + \tfrac{y}{2} H_2O + \frac{z}{2} N_2$$

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S-1
O-1
J-M

Ideal gas
Real gas

States of Matter