Chapter 5: Molecular weight

Q1.

Sol: No. of moles of hydrogen (n) = $\frac{wt}{Mol.wt} = \frac{6}{2} = 3$

Now from ideal gas equation

$$PV = nRT$$

$$So,\ V = \frac{nRT}{P} = \frac{3 \times 0.0821 \times 546}{1.5} = 89.65\,lit$$

Ans

Q2.

Sol: (i) For constant no. of moles of gases

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{740 \times 0.418}{300} = \frac{760 \times V_2}{273}$$ (at STP, P = 760 mm of Hg & T = 273 K)

$$V_2 = 0.3704\ lit$$

(ii) moles of gas = $\frac{Volume}{wt/volume} = \frac{0.3704}{22.4} = 0.0165$

$\therefore$ Molecular weight = $\frac{weight}{no.of\ moles} = \frac{3}{0.0165} = 181.4\ g$ **Ans**

Q3.

Sol: From PV = nRT

$$\frac{76}{76} \times 33.6 \times 10^{-3} = n \times 0.0821 \times 819$$

$$n = \frac{33.6 \times 10^{-3}}{67.24} = 0.4997 \times 10^{-3}$$

$$= 4.99 \times 10^{-4}\ mole$$

$\therefore$ Mol. wt = $\frac{weight}{no.of\ moles} = \frac{0.0625\,g}{4.99 \times 10^{-4}} = \frac{625}{4.99} = 125\,g$ **Ans**

No. of atom is one molecule of phosphorous vapour

$$n = \frac{Mol.wt}{At.wt} = \frac{125}{31} = 4$$ **Ans**

Q4.

Ans: Measured pressure = 753.6 mm of Hg

Aqs. tension = 13.6 mm of Hg

$\therefore$ So pressure due to gas (collected over water)

$$= 753.6 - 14.6 = 740\ mm\ of\ Hg$$

Volume of has = 28.9 mL

$T = 16^0C = 273 + 16 = 289$ K

PV = nRT

$$\frac{740}{740}\times 28.9\times 10^{-3} = n\times 0.0821\times 289$$

$$\frac{74\times 28.9\times 10^{-3}}{76\times 23.73} = n$$

$n = 1.186\times 10^{-3}$

$$\therefore \text{Mol. wt} = \frac{\text{weight}}{\text{no.of moles}}$$

$$= \frac{0.0926}{1.186\times 10^{-3}} = 78$$

$$\therefore \text{Vapour density} = \frac{78}{2} = 39$$

Ans

A

Q6.

Sol: Volume = 200 mL, 2 = 22.567 g

$T = 120^0C = (120 + 273)$ K = 39.3 K

Wt of Filled bulb = 22.3616 g

$\therefore$ Weight of gas = wt. of filled bulb – weight of bulb

= 22.8617 – 22.567 = 0.2947 g

Pressure exerted = 755 mm of Hg.

Pv = nRT

$$\frac{755}{760}\times 200\times 10^{-3} = n\times 0.0821\times 393\text{K}$$

$$n = \frac{755\times 0.02}{76\times 0.0821\times 393} = 0.006$$

$$\therefore \text{Mol wt} = \frac{0.2947}{0.006} = 47.8\text{g}$$

Ans

Q7.

Sol: Volume = 110 mL, $T = 99.6^0C = 372.6$ K,

Pressure = 747 mm of Hg, wt = 0.2704 g

Height of Hg column = 285.2 mm

$$PV = nRT \Rightarrow n = \frac{PV}{RT} = \left(\frac{747-285.2}{760}\times 110\times 10^{-3}\right)$$

$$= \frac{461.8\times 0.110}{23248.75} = \frac{50.798}{23248.75} = 0.0021$$

$$\therefore \text{Mol. wt} = \frac{\text{weight}}{\text{no.of moles}} = \frac{0.2704}{0.0021} = 122.6\text{g}$$

Ans

Q8.

Sol: Formula of silver salt = Ag_3A (A is trivalent anion)

$$Ag_3A \longrightarrow 3Ag$$

0.607 g 0.37 g

3×moles of Ag_3A = moles of Ag

$$\frac{3\times 0.607}{\text{Mol.wt.}Ag_3A} = \frac{0.37}{108}$$

Mol. wt $Ag_3A = \frac{3\times0.607\times108}{0.37} = 531.549$

Wt of $A^{3-} = 531.54 - 3\times108$

$= 531.54 - 3204 = 207.54$

Mol. formula of acid = H_3A

Mol. wt $= 3\times1 + 207.54 = 210.54$ g **Ans**

Q9.

Sol: If the molecular formula is Ag_2A

(A^{2-} is dibasic away)

$Ag_2A \longrightarrow 2Ag.$

0.304g 0.216g

$2\times$ moles of Ag_2A = moles of Ag.

$$\frac{2\times 0.304g}{Mol.wt\ of\ Ag_2A} = \frac{0.216}{108} = 0.002$$

$$Mol.\ wt\ of\ Ag_2A = \frac{0.304}{0.001} = 304\,g$$

$2\times108 + $ wt of $A^{2-} = 304$ g

Wt of $A^{2-} = 304 - 216 = 88$ g

Also Molecular formula of acid = H_2A

$\therefore$ Molecular weight of acid $= 2 + 88 = 90$ g; **Ans**

Q 10.

Sol: Let the base is B.

$\therefore B + H_2PtCl_6 \longrightarrow B_2H_2PtCl_6 \longrightarrow Pt$

Base 0.66 g 0.150 g

(dibasic)

If W is the weight of monoacidic base, then

molecular wt of platinchloride = 2W + 2 + 195 + 6 x 35.5

= (2W + 410) g

Now (2W + 140) g of compound contains 195 g of Pt

So 0.66 g of compound contains

$$\frac{195}{2W+410}\times0.66 = 0.150g$$

$\therefore$ Mol. wt of base = w = 224 g **Ans**

Q11.

Sol: Let the base is B.

$\therefore B + H_2PtCl_6 \longrightarrow BH_2PtCl_6 \longrightarrow Pt$

Base 39% by wt

(dibasic)

If w is the weight of base, then

$$\frac{195}{W+2+195+6\times 35.5}\times 100 = 39$$

$$\frac{195}{w+410}\times 100 = 39$$

$$0.39\,w + 159.9 = 195$$

$$0.39\,w = 35.1$$

$$W = \frac{35.1}{0.39} = 90$$

$\therefore$ Mol. wt of base = w = 90 g **Ans**

Q12.

Sol: $HA + NaOH \longrightarrow NaA + H_2O$

40 ml

0.5 N

Mole of HA = mole of NaOH

$$= 40\times 10^{-3}\times \frac{0.5}{10}\times 1$$

$$\frac{3}{\text{Mol.wt of acid}} = 20\times 10^{-3}$$

$\therefore$ Mol. wt. of acid $= \dfrac{3\times 10^{3}}{20} = \dfrac{300}{2} = 150\,g$ **Ans**

Q13.

Sol: $B(OH)_n$ + $HCl \longrightarrow BCl + H_2O$

Organic 15 ml

Base $\frac{1}{5}N$

$\therefore$ meq of $B(OH)_n$ = meq. of HCl

⇨ m moles × **acidity** $15\times\frac{1}{15}$

⇨ $\dfrac{366}{122}\times \text{acidity} = \dfrac{15}{3}$

$$\text{acidity} = \frac{15}{5\times 3} = 1$$

$\therefore$ Acidity of organic base = 1 **Ans**