

Chapter 5: Molecular weight

Q1.

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

Now from ideal gas equation

$$PV = nRT$$

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

Q2.

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

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

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

$$V_2 = 0.3704 \text{ lit}$$

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

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

Q3.

Sol: From $PV = nRT$

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

$$n = \frac{33.6 \times 10^{-3}}{67.24} = 0.4997 \times 10^{-3} \\ = 4.99 \times 10^{-4} \text{ mole}$$

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

No. of atom is one molecule of phosphorous vapour

$$n = \frac{\text{Mol.wt}}{\text{At.wt}} = \frac{125}{31} = 4$$
 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)

$$= 753.6 - 14.6 = 740 \text{ mm of Hg}$$

$$\begin{aligned}\text{Volume of gas} &= 28.9 \text{ mL} \\ T &= 16^\circ\text{C} = 273 + 16 = 289 \text{ K} \\ PV &= nRT \\ \frac{740}{740} \times 28.9 \times 10^{-3} &= n \times 0.0821 \times 289 \\ \frac{74 \times 28.9 \times 10^{-3}}{76 \times 23.73} &= n \\ n &= 1.186 \times 10^{-3}\end{aligned}$$

$$\begin{aligned}\therefore \text{Mol. wt} &= \frac{\text{weight}}{\text{no. of moles}} \\ &= \frac{0.0926}{1.186 \times 10^{-3}} = 78 \\ \therefore \text{Vapour density} &= \frac{78}{2} = 39 \quad \text{Ans}\end{aligned}$$

A

Q6.

Sol: Volume = 200 mL, $T = 22.567^\circ\text{C}$
 $T = 120^\circ\text{C} = (120 + 273) \text{ K} = 393 \text{ K}$
 Wt of Filled bulb = 22.3616 g
 \therefore Weight of gas = wt. of filled bulb – weight of bulb
 $= 22.8617 - 22.567 = 0.2947 \text{ g}$
 Pressure exerted = 755 mm of Hg.
 $PV = nRT$
 $\frac{755}{760} \times 200 \times 10^{-3} = n \times 0.0821 \times 393 \text{ K}$
 $n = \frac{755 \times 0.02}{76 \times 0.0821 \times 393} = 0.006$
 $\therefore \text{Mol wt} = \frac{0.2947}{0.006} = 47.8 \text{ g} \quad \text{Ans}$

Q7.

Sol: Volume = 110 mL, $T = 99.6^\circ\text{C} = 372.6 \text{ K}$,
 Pressure = 747 mm of Hg, wt = 0.2704 g
 Height of Hg column = 285.2 mm
 $PV = nRT \Rightarrow n = \frac{PV}{RT} = \left(\frac{747 - 285.2}{760} \times 110 \times 10^{-3} \right)$
 $= \frac{461.8 \times 0.110}{23248.75} = \frac{50.798}{23248.75} = 0.0021$
 $\therefore \text{Mol. wt} = \frac{\text{weight}}{\text{no. of moles}} = \frac{0.2704}{0.0021} = 122.6 \text{ g} \quad \text{Ans}$

Q8.

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

$$\begin{aligned}\text{Ag}_3\text{A} &\longrightarrow 3\text{Ag} \\ 0.607 \text{ g} &\quad 0.37 \text{ g} \\ 3 \times \text{moles of Ag}_3\text{A} &= \text{moles of Ag} \\ \frac{3 \times 0.607}{\text{Mol. wt. Ag}_3\text{A}} &= \frac{0.37}{108}\end{aligned}$$

$$\text{Mol. wt Ag}_3\text{A} = \frac{3 \times 0.607 \times 108}{0.37} = 531.549$$

$$\begin{aligned}\text{Wt of A}^{3-} &= 531.54 - 3 \times 108 \\ &= 531.54 - 3204 = 207.54\end{aligned}$$

Mol. formula of acid = H_3A

$$\text{Mol. wt} = 3 \times 1 + 207.54 = 210.54 \text{ g Ans}$$

Q9.

Sol: If the molecular formula is Ag_2A
(A^{2-} is dibasic away)



$$0.304 \text{ g} \quad 0.216 \text{ g}$$

$2 \times \text{moles of Ag}_2\text{A} = \text{moles of Ag}$

$$\frac{2 \times 0.304 \text{ g}}{\text{Mol. wt of Ag}_2\text{A}} = \frac{0.216}{108} = 0.002$$

$$\text{Mol. wt of Ag}_2\text{A} = \frac{0.304}{0.001} = 304 \text{ g}$$

$$2 \times 108 + \text{wt of A}^{2-} = 304 \text{ g}$$

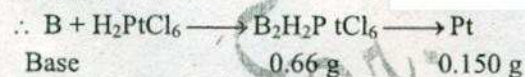
$$\text{Wt of A}^{2-} = 304 - 216 = 88 \text{ g}$$

Also Molecular formula of acid = H_2A

$$\therefore \text{Molecular weight of acid} = 2 + 88 = 90 \text{ g; Ans}$$

Q 10.

Sol: Let the base is B.



$$\begin{array}{ccc}\text{Base} & 0.66 \text{ g} & 0.150 \text{ g} \\ (\text{dibasic}) & & \end{array}$$

If W is the weight of monoacidic base, then

$$\begin{aligned}\text{molecular wt of platinumchloride} &= 2W + 2 + 195 + 6 \times 35.5 \\ &= (2W + 410) \text{ g}\end{aligned}$$

Now $(2W + 410) \text{ g}$ of compound contains 195 g of Pt

So 0.66 g of compound contains

$$\frac{195}{2W + 410} \times 0.66 = 0.150 \text{ g}$$

$$\therefore \text{Mol. wt of base} = w = 224 \text{ g Ans}$$

Q11.

Sol: Let the base is B.



$$\begin{array}{ccc}\text{Base} & & 39\% \text{ by wt} \\ (\text{dibasic}) & & \end{array}$$

If w is the weight of base, then

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

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

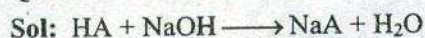
$$0.39w + 159.9 = 195$$

$$0.39w = 35.1$$

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

∴ Mol. wt of base = w = 90 g Ans

Q12.



40 ml

0.5 N

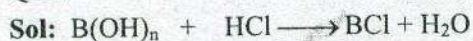
Mole of HA = mole of NaOH

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

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

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

Q13.



Organic 15 ml

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

∴ meq of $B(OH)_n$ = meq. of HCl

$$\Rightarrow \text{m moles} \times \text{acidity} = 15 \times \frac{1}{15}$$

$$\Rightarrow \frac{366}{122} \times \text{acidity} = \frac{15}{3}$$

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

∴ Acidity of organic base = 1 Ans