



GGSRDN

Educational Services Private Limited

9th, 10th, NEET, JEE(Main/Advanced)

अभ्यास ही सबसे बड़ा गुरु है।

CLASS : XI (PHYSICAL CHEMISTRY)

D P P

DAILY PRACTICE PROBLEM

Solutions

DPP-01 to 36

PHYSICAL CHEMISTRY

DPP No. # 1

1.* Molecular mass of $P_4 = 4 \times 31 = 124$ amu
 \therefore 124 amu of P_4 contains 1 molecule of P_4
 1 molecule of P_4 contains 4 atoms of P.

2.* (A) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$
 (B) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (C_3O_2) = $\frac{1}{68} \times N_A$
 (C) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$
 (D) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO_2) = $\frac{1}{44} \times N_A$

4.

S.No.	Sample	Relative Atomic Mass for the element	Gram Atomic mass of sample	Moles of sample	No. of atoms of sample	Mass removed from the sample	Mole removed
1.	8 g O	16	---	---	---	---	---
	For Example	16	16 g	$\frac{1}{2}$ Mole	$\frac{N_A}{2}$	2 g	$\frac{1}{8}$ Mole
2.	230 g Na	23	23g	10 Mole	10 N_A	46 g	2 Mole
3.	60 g Ca	40	40 g	$3/2$ Mole	$3/2 N_A$	40 g	1 Mole
4.	20 g He	4	4 g	5 Mole	5 N_A	12 g	3 Mole
5.	56 g N	14	14 g	4 Mole	4 N_A	7 g	$\frac{1}{2}$ Mole
6.	12 g Mg	24	24 g	$\frac{1}{2}$ Mole	$\frac{N_A}{2}$	6 g	$\frac{1}{4}$ Mole
7.	128 g S	32	32 g	4 Mole	4 N_A	32 g	1 Mole
8.	93 g P	31	31 g	3 Mole	3 N_A	46.5 g	$3/2$ Mole

5. Mass of $0.25 N_A$ atoms of X is 2.25 gram

$$\text{so, mass of 1 atom is} = \frac{2.25}{0.25 N_A} \text{ gram} = 1.5 \times 10^{-23} \text{ gram}$$

6. $W_{H_2SO_4} = 392 \text{ mg} = 392 \times 10^{-3} \text{ g}$

$$M_{H_2SO_4} = 98$$

$$\text{Left moles} = \text{Total moles} - \text{removed moles} = \frac{392 \times 10^{-3}}{98} - \frac{1.204 \times 10^{21}}{6.022 \times 10^{23}}$$

$$\text{Left moles} = 4 \times 10^{-3} - 2 \times 10^{-3} = 2 \times 10^{-3} \text{ moles.}$$

7. (A - p, s, r), (B - p, q, r), (C - p, q, r), (d - r).

8. Total number of moles of O-atoms = $2 \times n_{CO_2} + 5 \times n_{N_2O_5} + 1 \times n_{CO} + 2 \times n_{SO_2}$

$$= 2 \times \left(\frac{4.4}{44} \right) + 5 \times \left(\frac{6.022 \times 10^{22}}{N_A} \right) + 1 \times 0.2 + 2 \times \frac{1.12}{22.4} = 1$$

$$\therefore \text{Moles of } O_2 \text{ gas} = \frac{1}{2}$$

$$\therefore \text{Vol. of } O_2 \text{ gas at NTP} = \frac{1}{2} \times 22.4 = 11.2 \text{ L}$$

DPP No. # 2

2. No. of atoms of gold recovered = Moles of gold $\times N_A$

$$= \left(\frac{39.4 \times 10^3}{197} \right) \times N_A$$

$$= 1.2044 \times 10^{26}$$

5. Mole of element \times At. Mass of element = Mass of element

$$\left(\frac{1.5 \times 10^{22}}{N_A} \right) \times \text{At. Mass of element} = 0.9$$

\therefore At. Mass of element = 36 u.

8. 6×10^{23} molecules has mass = 18 gm

$$1 \text{ molecules has mass} = \frac{18}{6 \times 10^{23}} = 3 \times 10^{-23} \text{ gm}$$

$$= 3 \times 10^{-26} \text{ kg.}$$

10. (A) No. of molecules = $\frac{28}{28} \times N_A = N_A$ (B) No. of molecules = $\frac{46}{46} \times N_A = N_A$

(C) No. of molecules = $\frac{36}{18} \times N_A = 2N_A$ (max) (D) No. of molecules = $\frac{54}{108} \times N_A = 0.5N_A$

11. Molecular mass of $P_4 = 4 \times 31 = 124$ amu
 \therefore 124 g of P_4 contains 1 mole of $P_4 = N_A$ molecules of Phosphorus.
 1 mole of P_4 contains $4N_A$ atoms of P.

DPP No. # 3

1. For 24 carat, no of gold atoms = $\frac{300 \times 10^{-3}}{197} \times N_A$

For 20 carat, no of gold atoms = $\frac{300 \times 10^{-3}}{197} \times \frac{20 \times N_A}{24}$

$$= 7.64 \times 10^{20} \text{ i j e k . k q}$$

2. Removed mass = $\frac{11.2}{22.4} \times 32 + \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}} \times 16 = 32$ g

mass left = $64 - 32 = 32$ g.

3. (A) 32 g each of O_2 and S = $\frac{32}{32} = 1$ mole
 (B) 2 gram-molecule of $K_3[Fe(CN)_6] \Rightarrow$ has 2 moles of Fe \Rightarrow and 12 moles of C-atom
 (C) 144 g of oxygen atom = $\frac{144}{16} = 9$ mole of 'O' atom ; \therefore Moles of $O_3 = \frac{9}{3} = 3$
 7 (D) from 168 g i.e. 3 moles Fe \Rightarrow 1 mole Fe is removed i.e. \Rightarrow 2 moles of Fe is left.

4. In $Fe_2(SO_4)_3$:
 Moles of O- atoms : Moles of S- atoms = 12 : 3

$$\text{Moles of S- atoms} = \frac{3}{12} \times 7.2 = 1.8$$

No. of S- atoms = $1.8 N_A$

5. Mass of C = Moles of C \times At. mass of C
 = Moles of $CO_2 \times$ At. mass of C
 = $10 \times 12 = 120$ g

$$\begin{aligned} \text{Moles of O- atoms} &= 2 \times n_{\text{CO}_2} \\ &= 2 \times 10 \\ &= 20 = \text{g - atoms of O.} \end{aligned}$$

$$\text{No. of O- atoms} = 20 \times N_A = 1.2044 \times 10^{25}$$

$$\text{No. of molecules of CO}_2 = \text{Moles of CO}_2 \times N_A = 10 \times N_A$$

6. Let atomic mass of X is 'a' amu

$$(4a + 96) \text{ g X}_4\text{O}_6 \quad \text{-----} \quad 4a \text{ g X}$$

$$\therefore 10 \text{ g X}_4\text{O}_6 \text{ has -----} \left(\frac{4a \times 10}{4a + 96} \right) \text{ g X}$$

$$\frac{4a \times 10}{4a + 96} = 5.72 \quad \Rightarrow \quad a = 32.$$

7. Mass of Ca = $5 \times \frac{40}{100} = 2\text{g}.$

8. N → 1g 2g 3g
O → 0.57g 2.24g 5.11g

$$\text{O} \rightarrow \frac{0.57}{1} \quad \frac{2.24}{2} \text{ g} \quad \frac{5.11}{3} \text{ g}$$

$$\text{O} \rightarrow \frac{0.57}{1} \quad \frac{0.57 \times 2}{1} \quad \frac{0.57 \times 3}{1}$$

So, the mass ratio of oxygen combined with 1 g of nitrogen is simple ratio 1,2,3.

9. Ratio of weight of oxygen in samples = Ratio of valency of Cu in two compounds
= 2 : 1

10. R.D. = $\frac{M_{\text{SO}_3}}{M_{\text{CH}_4}} = \frac{80}{16} = 5.$

11. Molar mass of air at STP = $0.001293 \text{ g mL}^{-1} \times 22400 \text{ mL} = 28.7 \text{ g}$

$$\text{so V.D.} = \frac{28.7}{2} \approx 14.3$$

12. Element must be Al

Hence, volatile chloride will be AlCl_3 so V.D. = $\frac{M_{\text{AlCl}_3}}{2} = \frac{133.5}{2} = 66.75$

DPP No. # 4

1.* Weigh of 11.2 L gas at S.T.P. ----- 14 g

Weigh of 22.4 L gas at S.T.P. ----- $\frac{14}{11.2} \times 22.4 = 28 \text{ g}$

$$M_{\text{N}_2} = M_{\text{CO}} = 28$$

The gas could be N_2 or CO.

2. Let the molar mass of compound be 'M'

$$\text{Hence } \frac{M \times 6}{100} = 24$$

$$M = 400 \text{ g /mole}$$

$$3. \quad \text{Mole of Zn} = \frac{9.81}{65} \quad \text{Mole of Cr} = \frac{1.8 \times 10^{23}}{6.023 \times 10^{23}}$$

$$= 0.15 \quad = 0.3$$

$$\text{Mole of O} = 0.6$$

$$\therefore \text{ simple ratio } \text{Zn} = \frac{0.15}{0.15} \quad \text{Cr} = \frac{0.3}{0.15} \quad \text{O} = \frac{0.6}{0.15}$$

$$= 1 \quad = 2 \quad = 4$$



$$4. \quad \frac{\text{Mass of sulphur}}{\text{Mol. mass of compound}} \times 100 = \% \text{ of sulphur}$$

$$\therefore \left(\frac{2 \times 32}{M} \right) \times 100 = 0.032$$

$$\therefore M = 2,00,000$$

5. For S and O,

$$\text{S} \Rightarrow \frac{5}{32}$$

$$\text{O} \Rightarrow \frac{5}{16}$$

$$\text{Simple ratio } \text{S} \Rightarrow \frac{\frac{5}{32}}{\frac{5}{32}} \Rightarrow 1$$

$$\text{O} \Rightarrow \frac{\frac{5}{16}}{\frac{5}{32}} \Rightarrow 2$$

i.e. SO_2

For CH_2 ,

$$\% \text{ C} = \frac{12}{14} \times 100 = \frac{600}{7} \Rightarrow \text{H} \% = \frac{2}{14} \times 100 = \frac{100}{7}$$

For C_2H_4 ,

$$\% \text{ of C} = \frac{24}{28} \times 100 = \frac{600}{7} \Rightarrow \% \text{ of H} = \frac{4}{28} \times 100 = \frac{100}{7}$$

For CO_2 ,

$$\% \text{ of C} = \frac{12}{44} \times 100 = \frac{300}{11} \Rightarrow \% \text{ of O} = \frac{32}{44} \times 100 = \frac{800}{11}$$

6. 0.1 mole of carbohydrate with E.F. CH_2O contains 1 g of hydrogen.

\therefore 1 mole of carbohydrate will contain hydrogen
= 10 g = 10 g atoms

In CH_2O , g atomic ratio of C : H : O = 1 : 2 : 1.

\therefore With 10 g atoms of H, g atoms of C combined = 5 and g atoms of O combined = 5. Hence, actual formula (molecular formula) will be $\text{C}_5\text{H}_{10}\text{O}_5$.

7. Water is electrolysed as follows



36 g H_2O yield = 1 mol of oxygen

$$1 \text{ g of } \text{H}_2\text{O} \text{ will yield} = \frac{1}{36} \text{ mol of } \text{O}_2$$

$$\therefore 90 \text{ g of water will yield} = \frac{1}{36} \times 90 \text{ mol of } \text{O}_2$$

8.* According to stoichiometry of reaction option A, B and D are correct.

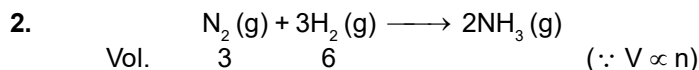
DPP No. # 5

$$1. \quad \text{For 1st reaction } \frac{\text{Mole of } \text{S}_8}{1} = \frac{\text{Mole of } \text{SO}_2}{8}$$

$$\text{Mole of } \text{SO}_2 = \frac{1 \times 8}{1} = 8$$

For IInd reaction $\frac{\text{Mole of SO}_2}{2} = \frac{\text{Mole of SO}_3}{2} = 8$

wt of SO₃ = 8 × 80 = 640 g.



L.R. $\frac{6 \times 2}{3} = 4 \text{ L.}$

3. LR \rightarrow HCl, so Mole of H₂ = $\frac{\text{Mole of HCl}}{2} = \frac{0.52}{2} = 0.26$

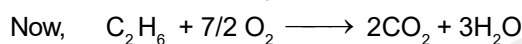
4.* Moles of C₂H₆ = 3

moles of C₂H₆ mixed = $\frac{60}{30} = 2$

total mole of C₂H₆ = 5

moles removed = $\frac{2.4 \times 10^{24}}{6 \times 10^{23}} = 4$

\therefore moles of C₂H₆ left = 1



clearly 3 moles of H₂O or 54 gm H₂O will be formed

volume of H₂O = 54 ml

Ans. 54

5. Let the mass of CaCO₃ = x g
then ,mass of MgCO₃ = (3.68 - x) g

moles of CaCO₃ = $\frac{x}{100}$

moles of MgCO₃ = $\frac{3.68 - x}{84}$

Applying POAC for C-atoms

$\frac{x}{100} + \frac{3.68 - x}{84} = 0.04$

x = 2 g

$\therefore n_{\text{CaCO}_3} = \frac{2}{100} = 0.02$ and $n_{\text{MgCO}_3} = \frac{1.68}{84} = 0.02$

\therefore mole % of CaCO₃ = $\frac{0.02}{0.04} \times 100 = 50\%$

\therefore mole % of MgCO₃ = $\frac{0.02}{0.04} \times 100 = 50\%$

6.* (A) Limiting reagent may neither have the least mass nor the least moles among all the reactants available in a chemical reaction.



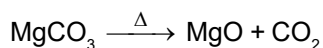
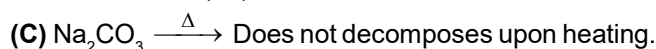
Mass m m

Mole $\left(\frac{m}{27}\right)$ $\left(\frac{m}{32}\right)$

$\frac{\text{mole}}{\text{st. coeff.}}$ $\frac{m}{27 \times 4}$ $\frac{m}{32 \times 3}$

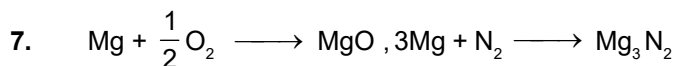
$\left(= \frac{m}{108}\right)$ $\left(= \frac{m}{96}\right)$

(LR)



$\frac{3}{5} \times 1 \text{ mole}$ $\frac{3}{5} \times 1 \text{ mole}$

So, moles of CO₂ produced = $\frac{3}{5} \times 1 = 0.6 \text{ mole.}$



$$a \qquad \qquad a \quad (5-a) \qquad \frac{(5-a)}{3}$$



$$a \qquad \qquad a \qquad \frac{5-a}{3} \qquad \frac{2(5-a)}{3} \quad (5-a)$$

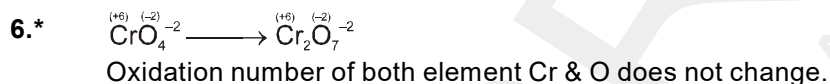
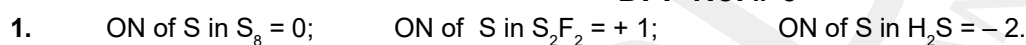
∴ Total moles of $\text{MgCl}_2 = a + (5-a) = 5$ moles

Alternatively :

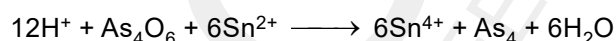
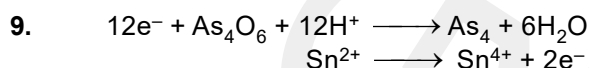
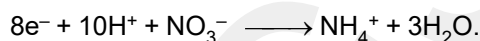
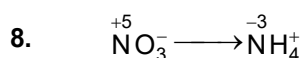
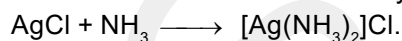
Apply POAC on Mg

$$\begin{array}{l} \text{Mg} \longrightarrow \text{MgCl}_2 \\ 5 \text{ moles} \qquad \qquad x \text{ moles} \\ 1 \times 5 = x \times 1 \quad \Rightarrow \quad x = 5 \text{ moles} \end{array}$$

DPP No. # 6



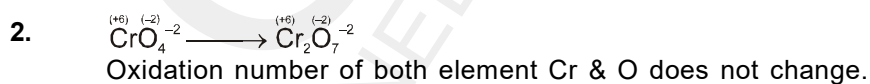
7. Those reaction in which oxidation number of any element do not change not a redox reaction.



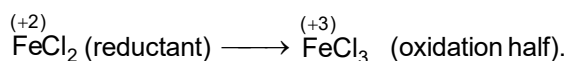
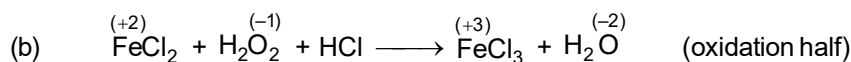
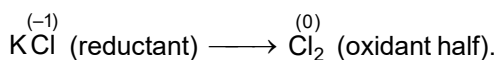
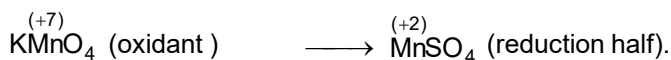
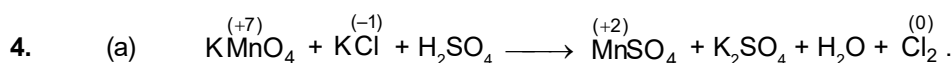
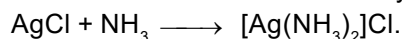
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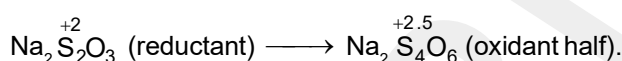
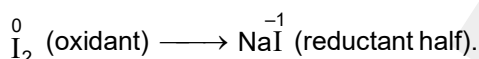
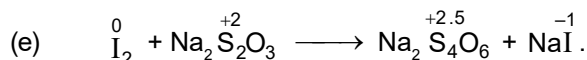
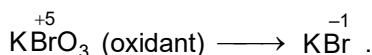
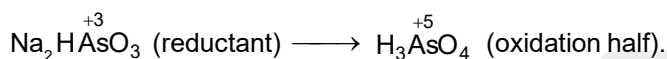
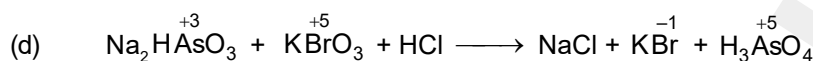
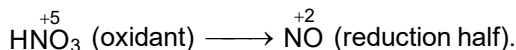
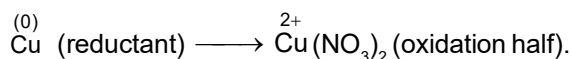
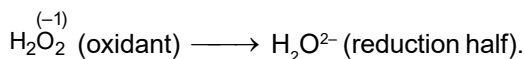


Disproportionation reaction. In this reaction, P element present in intermediate oxidation state and P undergoes both oxidation and reduction.

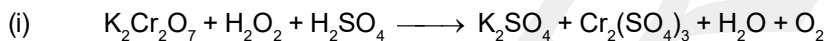


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5.

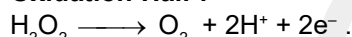


Mass Balance and Charge Balance :

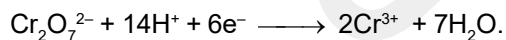
Remove the spectator ion — 2K^+ , SO_4^{2-} .



Oxidation Half :



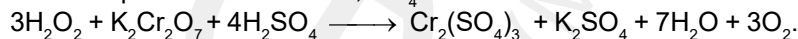
Reduction Half :



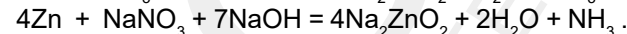
Total loss electrons = total gain electrons.



Add the spectator ion — 2K^+ , SO_4^{2-} .

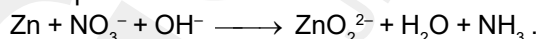


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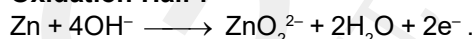


Mass Balance and Charge Balance :

Remove the spectator ion — Na^+



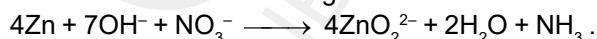
Oxidation Half :



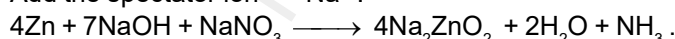
Reduction Half :



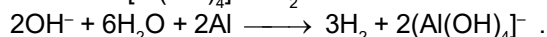
Total loss electrons = total gain electrons.



Add the spectator ion — Na^+ .

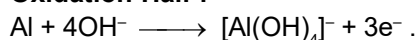


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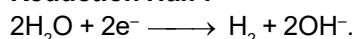


Mass Balance and Charge Balance :

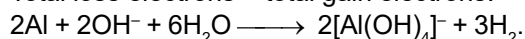
Oxidation Half :



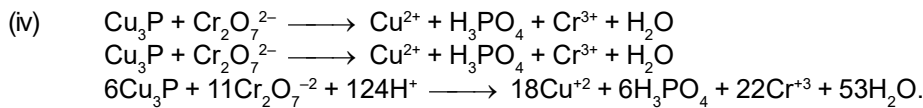
Reduction Half :



Total loss electrons = total gain electrons.

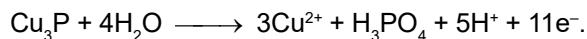


Note : If H_2 or O_2 formed in reaction. It means H_2 or O_2 produced from H_2O molecule.

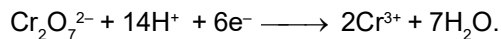


Mass Balance and Charge Balance :

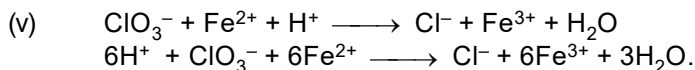
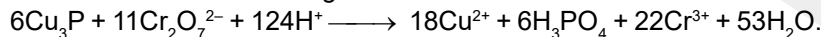
Oxidation Half :



Reduction Half :

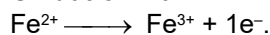


Total loss electrons = total gain electrons.

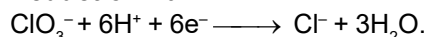


Mass Balance and Charge Balance :

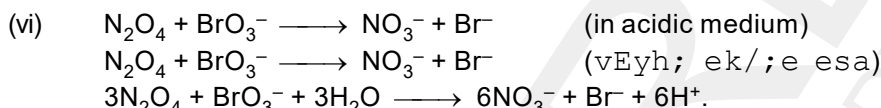
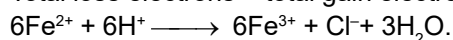
Oxidation Half :



Reduction Half :

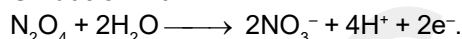


Total loss electrons = total gain electrons.

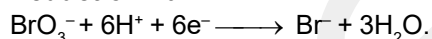


Mass Balance and Charge Balance :

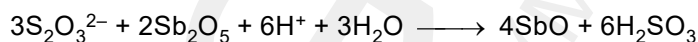
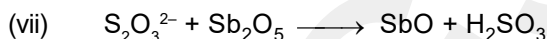
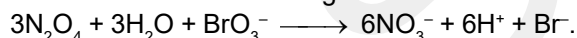
Oxidation Half :



Reduction Half :

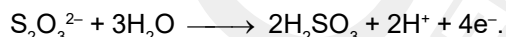


Total loss electrons = total gain electrons.



Mass Balance and Charge Balance :

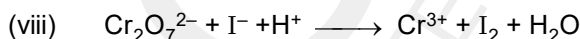
Oxidation Half :



Reduction Half :

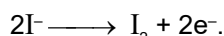


Total loss electrons = total gain electrons.

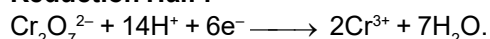


Mass Balance and Charge Balance :

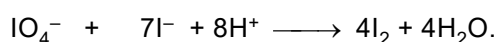
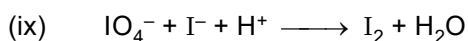
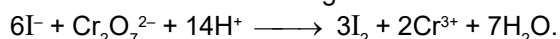
Oxidation Half :



Reduction Half :

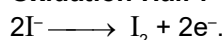


Total loss electrons = total gain electrons.

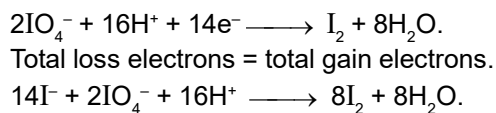


Mass Balance and Charge Balance :

Oxidation Half :



Reduction Half :



DPP No. # 8

- $$M = \frac{n_{\text{solute}}}{V_{\text{solution}}}$$

$$\frac{0.8}{1000} = \frac{100 \times 10^{-3}}{\text{vol. of solution}}$$

vol. of solution = 125 ml
(Here n_{solute} = mole of solute, V_{solution} = vol. of solution).
- $$\text{Volume} = \frac{\text{No. of moles}}{\text{Molarity}} = \frac{36.5/36.5}{1} = 1$$
- $$M = \frac{2.8}{100} \times 1000 = \frac{1}{2} \text{ M}$$
- $$M_1V_1 = M_2V_2$$

$$\frac{49}{98} \times 1.18 \times 10 \times 75 = M_2 \times 590$$
- (A) Molarity of second solution is = $\frac{10 \times d \times x}{M} = 1 \text{ M}$
 (B) Volume = 100 + 100 = 200 ml
 (D) Mass of $\text{H}_2\text{SO}_4 = \frac{200 \times 1}{1000} \times 98 = 19.6 \text{ gm}$.
- $$\text{Molarity of cation} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2} = \frac{0.2 \times 100 + 0.1 \times 400}{500} = \frac{0.6}{5} = 0.12 \text{ M}$$

$$\text{Molarity of Cl}^- = \frac{3(0.2)100 + 0.1 \times 400}{500} = \frac{0.6 + 0.4}{5} = 0.2 \text{ M}$$
- mass of NaCl in Ist solution = 120 × 0.4 = 48 g
 mass of NaCl in IInd solution = 200 × 0.15 = 30 g
 Total mass of NaCl = 30 + 48 = 78 g
 Total mass of solution = 120 + 200 = 320 g

$$\text{mass \% of NaCl} = \frac{78}{320} \times 100 = 24.375 \%$$
- mass of solvent = 320 – 78 = 242 g.

$$\text{molality} = \frac{78}{242} \times 1000 = 5.5 \text{ m}$$
- $$\text{Mole fraction of solute} = \frac{\frac{78}{58.5}}{\frac{78}{58.5} + \frac{242}{18}} = 0.09$$
- $$\text{Molarity} = \frac{\frac{78}{58.5}}{1.6} \times 1000 = 6.66 \text{ M}$$

DPP No. # 9

- $$1.66 \times 10^{-24} \text{ g} \longrightarrow 1 \text{ amu}$$

$$\therefore 6 \times 10^{-23} \text{ g} \longrightarrow \frac{6 \times 10^{-23} \times 1}{1.66 \times 10^{-24}} = 36 \text{ amu}$$

\therefore Atomic mass of X = 36 amu

$$\therefore \text{Moles of X} = \frac{144}{36} = 4$$

2. Molecular wt. of gas = 3a

$$\text{no. of moles of gas} = \frac{w}{3a}$$

3. Total number of protons = $\frac{11.2}{22.4} \times 18 \times N_A = 9N_A$.

4. $1 \times 10^3 \text{ kg/m}^3 = 1 \text{ g/mL}$. [Since, $1\text{m}^3 = 10^6 \text{ cm}^3 = 10^6 \text{ mL}$.]
= 1 gm/cc

$6.022 \times 10^{23} \text{ H}_2\text{O}$ molecule weigh _____ 18 g

$$1 \text{ H}_2\text{O} \text{ molecule weigh } \frac{18}{6.022 \times 10^{23}} \text{ g} = 3 \times 10^{-23} \text{ g}$$

$$d = \frac{\text{mass}}{\text{volume}}, \quad \text{So, volume} = \frac{3 \times 10^{-23} \text{ g}}{1(\text{g/mL})} = 3 \times 10^{-23} \text{ mL.}$$

5. molecular weight of air at STP = $0.001293 \text{ g mL}^{-1} \times 22400 \text{ mL} = 28.7 \text{ g}$

$$\text{so V.D.} = \frac{28.7}{2} \approx 14.3$$

6.

(i) False

According to law of definite proportions, two elements always combine in the same ratio by mass, only if they form the same compound.

(ii) True Refer notes.

(iii) True

$$\frac{2.8}{22.4} \times M_{(g)} = 5.5 \text{ g.}$$

So, $M_{(g)} = 44$. (CO_2 or N_2O).

(iv) True

$$\text{Total number of atoms} = \frac{5}{60} \times N_A \times 8 = \frac{2N_A}{3} \text{ (in both cases).}$$

7. wt. of compound = 2.89 g

wt. of osmium = 2.16 g

wt. of oxygen = $2.89 - 2.16 = 0.73 \text{ g}$

$$\text{Mole of osmium} = \frac{2.16}{190} = 0.01136 \text{ and mole of oxygen} = \frac{0.73}{16} = 0.04562$$

$$\text{so relative mole of osmium} = \frac{0.01136}{0.01136} = 1$$

$$\text{relative mole of oxygen} = \frac{0.045625}{0.01136} = 4$$

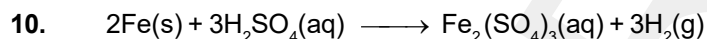
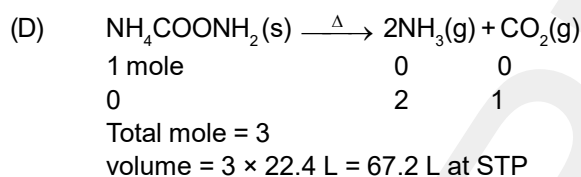
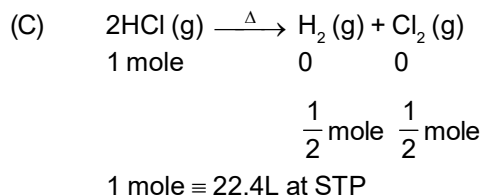
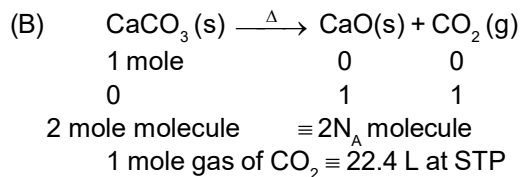
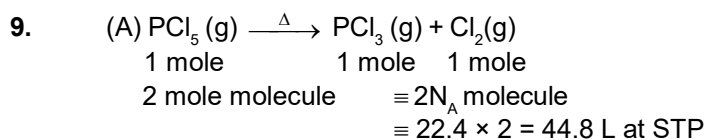
so, empirical formula = OsO_4 .

8. $\text{N}_2\text{O}_5(\text{s}) \xrightarrow{\Delta} 2\text{NO}_2(\text{s}) + \frac{1}{2} \text{O}_2$ (Balanced reaction)

$$\frac{\text{Mole of O}_2}{1/2} = \frac{\text{Mole of NO}_2}{2}$$

$$\frac{1.6}{32} \times 2 \times 2 = \text{Mole of NO}_2 = 0.2$$

$$\text{wt of NO}_2 = 0.2 \times 46 = 9.2 \text{ g.}$$



$$\text{Moles of H}_2 = \frac{6}{2} = 3 \text{ mole}$$

$$\text{Moles of Fe} = \frac{3}{3} \times 2 = 2$$

$$\text{mass of Fe} = 2 \times 56 = 112 \text{ g.}$$

$$\% \text{ Fe} = \frac{112}{140} \times 100 = 80\%.$$

11. Moles of I_2 produced = $\frac{381 \times 10^3}{254} = \frac{3 \times 10^3}{2}$

$$\text{for this much moles of } \text{I}_2, \text{ moles of AgNO}_3 \text{ required} = \frac{3}{2} \times 2 \times 10^3$$

$$\therefore \text{mass of AgNO}_3 \text{ required} = 3 \times 170 \times 10^3 = 510 \text{ kg}$$

12. moles of $\text{NaI} = \frac{150}{150} \times 10^3 = 10^3$

$$\text{moles of AgNO}_3 = \frac{85}{170} \times 10^3 = 5 \times 10^2$$

clearly AgNO_3 is limiting reagent

$$\therefore \text{moles of } \text{I}_2 \text{ formed} = \frac{\text{moles of AgNO}_3}{2} = \frac{5 \times 10^2}{2} = 250$$

13. Moles of Ag recovered = $\frac{324}{108} = 3$

Hence moles of NaI required to produce this Ag = 3

$$\therefore \text{mass of NaI} = 3 \times 150 = 450 \text{ g}$$

DPP No. # 10

1. Volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times (2.1)^2 \times 10$$

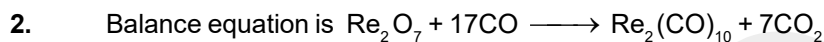
$$= 138.6 \text{ cm}^3$$

$$\text{Mass of cylinder} = V \times d = 138.6 \times \frac{100}{21} = 660 \text{ g}$$

$$\text{Mass of cobalt} = \frac{29.5}{100} \times 600 = 194.7 \text{ g.}$$

$$\text{Moles of cobalt} = \frac{194.7}{59} = 3.3$$

$$\therefore \text{Number of atoms of cobalt} = 3.3 N_A$$



3. 100 g haemoglobin has = 0.25 g Fe

$$89600 \text{ g} \text{ ----- } " \text{ ----- } " \text{ ----- } = \frac{0.25 \times 89600}{100} = 224 \text{ g Fe}$$

$$\therefore 1 \text{ mol of Haemoglobin has} = \frac{224}{56} \text{ mol Fe atoms} = 4 \text{ mol Fe.}$$

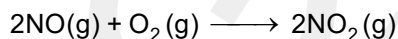
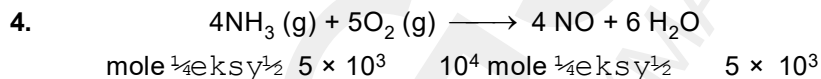
$$\text{Now mole of haemoglobin given} = \frac{4480 \text{ g}}{89600 \text{ g/mol}} = 0.05 \text{ mol}$$

$$\text{mol. wt of } \text{K}_4[\text{Fe}(\text{CN})_6] = 368 \text{ g/mol}$$

$$\text{Applying POAC for Fe atoms} - \text{mole of Haemoglobin} \times 4 = \text{mole of } \text{K}_4[\text{Fe}(\text{CN})_6] \times 1$$

$$0.05 \times 4 = \frac{\text{weight of } \text{K}_4[\text{Fe}(\text{CN})_6]}{368 \text{ g/mol}} \times 1$$

$$\text{weight of } \text{K}_4[\text{Fe}(\text{CN})_6] = 0.05 \times 4 \times 368 \text{ g} = 73.6 \text{ g}$$



$$5 \times 10^3 \qquad \qquad \qquad 5 \times 10^3$$



$$5 \times 10^3 \qquad \qquad \qquad \frac{2}{3} \times 5 \times 10^3$$

$$\text{molarity} = \frac{2}{3} \times \frac{5 \times 10^3}{500} = 6.66 \text{ M.}$$

5. Moles of water reacted = $\frac{180 \times 10^3}{18} = 10^4$

$$\therefore \text{moles of } \text{NO}_2 \text{ required} = 30 \times 10^3 = \text{mole of } \text{NH}_3 \text{ required}$$

$$\therefore \text{volume of air at STP} = \frac{30 \times 10^3 \times 22.4}{0.2} = 3.36 \times 10^6 \text{ L.}$$

6. Moles of $\text{NH}_3 = \frac{170}{17} = 10 \times 10^3$

$$\therefore \text{moles of } \text{H}_2\text{O} \text{ formed} = \frac{6}{4} \times 10 \times 10^3$$

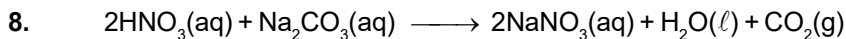
$$\therefore \text{mass of } \text{H}_2\text{O} \text{ formed} = \frac{6}{4} \times 10 \times 10^3 \times 18$$

$$\therefore \text{volume of } \text{H}_2\text{O} \text{ formed} = 15 \times 18 \text{ L} = 270 \text{ L.}$$

7. Molarity = $0.025 = \frac{\text{Mole}}{50} \times 1000$

$$\text{Mole} = \frac{50 \times 0.025}{1000}$$

$$\text{wt. of Na}_2\text{Cr}_2\text{O}_7 = \frac{50 \times 0.025}{1000} \times 270 = 0.3375 \text{ gm.}$$



$$\frac{\text{Millmole of HNO}_3}{2} = \frac{\text{Millmole of Na}_2\text{CO}_3}{1}$$

$$0.25 \times V_{\text{ml}} = 2 \times 50 \times 0.15$$

$$V_{\text{ml}} = \frac{2 \times 50 \times 0.15}{0.25} = 60 \text{ mL.}$$

9. $N_1V_1 + N_2V_2 = N_TV_T$

$$2.5V_1 + 0.4V_2 = 3 \times 1$$

$$2.5V_1 + 0.4(3 - V_1) = 3$$

$$2.5V_1 + 1.2 - 0.4V_1 = 3$$

$$2.1V_1 = 1.8$$

$$V_1 = \frac{1.8}{2.1} = \frac{6}{7}$$

$$V_2 = 3 - \frac{6}{7} = \frac{15}{7}$$

$$\frac{V_1}{V_2} = \frac{6}{7} \times \frac{7}{15} = 2 : 5$$

10. $M = \frac{86 \times 1.787}{98} \times 10 = 15.68 \text{ M}$

$$M_1V_1 = M_2V_2$$

$$15.68 \times V_1 = 0.2 \times 1000$$

$$V_1 = 12.75 \text{ ml.}$$

11. For neutralisation

m moles of $\text{H}_2\text{SO}_4 = 2 \times m$ moles of NaOH

$$\frac{98}{98} \times 1.84 \times 10 \times 10 = 2 \times 2.5 \times V$$

$$V = 147.2 \text{ ml}$$

12. (i) % (w/w) = $\frac{10}{90+10} \times 100 = 10\%$

(ii) % (w/v) = $\frac{10}{(90+10)} \times 100 = 12\%$
 $\frac{10}{1.2}$

(iii) Mole fraction of NaOH = $\frac{10}{40} = \frac{1}{21}$
 $\frac{\frac{10}{40}}{\frac{10}{40} + \frac{90}{18}}$

(iv) Molarity = $\frac{10}{40} \times 1000 = 3 \text{ M}$
 $\frac{(90+10)}{1.2}$

(v) Molality = $\frac{10}{90} \times 1000 = 2.78 \text{ M.}$

13. 5.85% (w/v) \rightarrow 5.85 g NaCl / 100 ml

NaCl

$$\text{So, Mole/ml} = \frac{5.85}{58.5} = 0.1/100 \text{ ml}$$

$$\text{Cl}^- / \text{ml} = \frac{0.1 \times 1}{100}$$

5.55 % (w/v) \rightarrow 5.55 g CaCl_2 / 100 ml

CaCl_2

$$\text{So, Mole/ml} = \frac{5.55}{111} = 0.05 \text{ ml}$$

$$\text{Cl}^- / \text{ml} = \frac{0.05 \times 2}{100} = \frac{0.1}{100}$$

14. (A) 1 M glucose solution \equiv 1 mole of solute/L
 \equiv 180 g solute/L
 \equiv $(180 \text{ g}/1000) \times 100 = 18\%$ (w/v)
- (B) 3 M urea solution (NH_2CONH_2) \equiv 3 mole of solute/L
 \equiv (60×3) g of solute/L
 \equiv $(180 \text{ g}/1000) \times 100 = 18\%$ (w/v)
- (C) 3 M CH_3COOH solution \equiv 3 mole of solute/L
 \equiv (3×60) g of solute/L
 \equiv $(180 \text{ g}/1000) \times 100 = 18\%$ (w/v)
- (D) 1 M H_2SO_4 solution \equiv 1 mole of solute/L
 \equiv 98 g of solute/L
 \equiv $\frac{98}{1000} \times 100 = 9.8\%$ (w/v)

DPP No. # 11

- Mass of a neutron = 1.675×10^{-24} g mass of a proton = 1.672×10^{-24}
- Carbon is ${}_6\text{C}^{12}$ and silicon is ${}_{14}\text{Si}^{28}$.
- No change by doubling mass of electrons, however by reducing mass of neutron to half total atomic mass becomes 6 + 3 instead of 6 + 6. Thus reduced by 25%.
- ${}_Z\text{X}^A$, $A = N + P$
- $\text{NO}_3^- = 7 + 8 \times 3 + 1 = 32$
- fraction = $\frac{\text{vol. of nucleus}}{\text{vol. of atom}} = \frac{\frac{4}{3}\pi (10^{-13})^3}{\frac{4}{3}\pi (10^{-8})^3} = 10^{-15}$.
- $2(p + n) + 3p = 140 \quad \therefore 7x = 140 \quad \therefore x = 20$
 $\therefore p = e = n = 20 \quad \therefore$ Total number of nucleons = $n + p = 40$
 \therefore Element = Calcium

DPP No. # 12

1. $PE = - \frac{KZe^2}{r}$.
- 2.* Isotopes have same atomic number but different mass number.
3. Isobars have same mass number.
- 4.* Isotones have same number of neutrons.
5. Each has 10 electrons.
In CH_3^+ = 6 + 3 - 1 = 8 e
In H_3O^+ = 3 + 8 - 1 = 10 e
- 6.* Isoelectronic species have same number of electrons.

7. $\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3}$
 $\Rightarrow \frac{1}{2} = \left(\frac{A_1}{A_2}\right)^{1/3}$
 $\Rightarrow \frac{A_1}{A_2} = \frac{1}{8}$
 ratio of atomic mass number.

8. $r_0 = \frac{4KZe^2}{M_0v_0^2}$
 $\Rightarrow 2r_0 = \frac{4KZe^2}{M_0v'^2}$
 $\Rightarrow r_0v_0^2 = 2r_0v'^2$
 $\Rightarrow v' = \frac{v_0}{\sqrt{2}}$

9. Given $R = \frac{4KZe^2}{M_0v_0^2}$
 $\therefore R' = \frac{4KZe^2}{M_0\left(\frac{v_0}{2}\right)^2} = 4R$
 $\therefore \% \text{ error} = \frac{4R - R}{R} \times 100 = 300\%$.

10. Use $R = \frac{4Kze^2}{m_\alpha v_\alpha^2}$.

11. Definition

12. In one second, wave can travel distance = $v \times \lambda = 10 \times 2.5 \text{ m} = 25 \text{ m}$
 In 40 seconds, it will travel = $25 \times 40 \text{ m} = 1000 \text{ m}$.

DPP No. # 13

1. Maximum wave length will correspond to minimum frequency as $\lambda \propto \frac{1}{\nu}$, and that is given for red light in the spectrum.

$$\lambda_{\text{max.}} = \frac{C}{\nu_{\text{min.}}} = \frac{3 \times 10^8 \text{ m/s}}{4 \times 10^{14} \text{ s}^{-1}} = 750 \times 10^{-9} \text{ m}.$$

From (1) and (3): $h\nu_1 = 2KE_{\max 1}$ or $h\left(\frac{\nu_2}{2}\right) = 2\left(\frac{KE_{\max 2}}{3}\right)$

∴ % of incident energy converted into max KE in II experiment

$$= \frac{KE_{\max 2}}{h\nu_2} \times 100 = \frac{3}{4} \times 100 = 75\%.$$

2. The maximum KE of photoelectron is corresponding to maximum stopping = 18.6 eV

$$\therefore E_{\text{incident}} = W + KE_{\max}$$

$$\frac{12400}{400} \text{ eV} = W + 18.6 \text{ eV}$$

$$W = 12.4 \text{ eV}$$

$$\therefore \lambda_0 = \frac{12400}{12.4} \text{ \AA} = 1000 \text{ \AA}$$

3. Only for Single electron species.

$$4. \frac{1}{\lambda_1} = RZ^2 \left[\frac{1}{n_C} - \frac{1}{n_A} \right] \dots\dots (1)$$

$$\frac{1}{\lambda_1} = RZ^2 \left[\frac{1}{n_C} - \frac{1}{n_B} \right] \dots\dots (ii)$$

$$\frac{1}{\lambda_3} = RZ^2 \left[\frac{1}{n_B} - \frac{1}{n_A} \right]$$

$$\frac{1}{\lambda_3} = \frac{1}{\lambda_1} - \frac{1}{\lambda_2} = \frac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2} = \frac{1}{3000}$$

$$\lambda_3 = 3000 \text{ \AA}.$$

$$5. \text{ For } r = 0.52 \text{ \AA} \times \frac{12}{1}$$

$$\text{ For } L^{2+} r_1 = 0.529 \times \frac{12}{3}$$

$$\frac{r}{r_1} = 3 \quad \Rightarrow \quad r_1 = \frac{r}{3}$$

$$6. r_4 - r_3 = 7 \times r_1$$

$$7. \text{ Use } V_n = 2.185 \times 10^8 \left(\frac{Z}{n} \right) \text{ cm/sec.}$$

$$8. \text{ PE} = - \frac{KZe^2}{r}.$$

$$9. \frac{nh}{2\pi} = \frac{2h}{\pi} \quad \Rightarrow \quad n = 4,$$

$$\text{P.E.} = 2(\text{T.E.}) = 2 \left(-13.6 \times \frac{2^2}{4^2} \right) = -6.8 \text{ eV.}$$

10. (A) $E_n^{-y} \propto r_n / Z$

$$\left(\frac{Z^2}{n^2} \times 13.6 \text{ eV} \right)^{-y} \propto \frac{1}{Z} \left(\frac{n^2}{Z} \times 0.529 \text{ \AA} \right)$$

$$y = 1$$

$$(B) \ell_n \propto n^x \Rightarrow \frac{nh}{2\pi} \propto n^x \Rightarrow x = 1$$

(C) Potential energy = 2 (total energy)

$$(D) T_n \propto \frac{n^3}{Z^2} \Rightarrow t = -2 \Rightarrow m = -3.$$

DPP No. # 15

1. $E_{I \text{ Photon}} + E_{II \text{ Photon}} = E_{\text{Single Photon}}$

$$hc\bar{\nu}_1 + hc\bar{\nu}_2 = \frac{hc}{\lambda}$$

$$\therefore \lambda = \frac{1}{\bar{\nu}_1 + \bar{\nu}_2} = \frac{1}{5.25 \times 10^8 + 7.25 \times 10^8} = \frac{1}{12.5 \times 10^8} = 8 \times 10^{-10} \text{ m} = 8 \text{ \AA}$$

2. Use : $E_1 - E_2 / E_2 - E_3$

3. $\frac{r_1}{r_2} = \frac{1}{4} \Rightarrow \frac{r_3}{r_4} = \frac{9}{16} \Rightarrow \frac{r_2}{r_4} = \frac{1}{4}$

So corresponding energy of ratio $\frac{1}{4}$ is $E_2 - E_1$ and $E_4 - E_2$.

4. $\frac{R_1}{R_2} = \frac{4}{9} = \frac{n_1^2}{n_2^2}$, hence $\frac{n_1}{n_2} = \frac{2}{3}$. So, $\frac{f_1}{f_2} = \frac{n_2^3}{n_1^3} = \frac{27}{8}$.

5. Electrostatic force of attraction $F \propto \frac{Z^3}{n^4}$

$$\therefore \frac{(F_{n=3})_{\text{He}^+}}{(F_{n=2})_{\text{Li}^{2+}}} = \frac{2^3/3^4}{3^3/2^4} = \left(\frac{2}{3}\right)^7 = \left(\frac{3}{2}\right)^{-7} \therefore x = -7 \quad F = \frac{KZe^2}{R^2}$$

6. Order of energy \rightarrow Violet > Blue > yellow > red

Order of energy $\rightarrow E_{2 \rightarrow 1} > E_{5 \rightarrow 2} > E_{6 \rightarrow 3} > E_{4 \rightarrow 3}$

\therefore Violet ($2 \rightarrow 1$), Blue ($5 \rightarrow 2$), yellow ($6 \rightarrow 3$), Red ($4 \rightarrow 3$)

7.* BE for ($n = 3$) = $1.51 Z^2 = 12 \text{ eV}$ (given)

$$\therefore Z^2 = 12/1.51$$

I Excitation potential = $10.2 Z^2 = 10.2 \times (12/1.51) = 81 \text{ V}$

II Excitation potential = $12.09 Z^2 = 12.09 \times (12/1.51) = 96 \text{ eV}$

Ionisation potential = $13.6 Z^2 = 13.6 (12/1.51) = 108 \text{ V}$

BE of ($n = 2$) = $3.4 Z^2 = 3.4 \times (12/1.51) = 27 \text{ eV}$

8. Let the given transition for both the species is $n_1 \rightarrow n_2$

Then $X_{\text{cm}^{-1}} = R \times 2^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$ For He^+ (i)

and (wave no.) $\text{Be}^{3+} = R \times 4^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$ For Be^{3+} (ii)

From eq. (i) and (ii) (wave no.) $\text{Be}^{3+} = 4x \text{ cm}^{-1}$.

DPP No. # 16

1. $\lambda = \frac{h}{p} = \frac{h}{mv} = \frac{h}{v^2}$

but $v^2 = \frac{2KE}{m}$ therefore $\lambda = \frac{hm}{2KE}$

2. Use $C = v\lambda \Rightarrow \bar{u} = \frac{1}{\lambda}$

3. $K.E._{\text{proton}} = 1 + (1)(3) = 4 \text{ eV} \therefore \lambda_p = \frac{h}{\sqrt{2m_p(KE)_p}}$ & $KE_{\alpha\text{-particle}} = 20 - (2)(2) = 16 \text{ eV} \therefore \lambda_\alpha = \frac{h}{\sqrt{2m_\alpha(KE)_\alpha}}$

$$\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha (KE)_\alpha}{m_p (KE)_p}} = \sqrt{\frac{4 \times 16}{1 \times 4}} = \frac{4}{1}$$

4.*
 $4.25 = (W_0)_A + (K.E.)_A$
 $4.70 = (W_0)_B + (K.E.)_A - 1.5$
 So $(W_0)_B - (W_0)_A = 0.45 + 1.5$
 $= 1.95$

Now, $\lambda_B = 2\lambda_A$

$$\frac{h}{\sqrt{2m(K.E.)_B}} = \frac{2h}{\sqrt{2m(K.E.)_A}}$$

So $(K.E.)_A = 4 (K.E.)_B$
 $4.25 - (W_0)_A = 4 [4.7 - (W_0)_B]$
 $4(W_0)_B - (W_0)_A = 14.55$
 So $(W_0)_B = 4.2 \text{ eV}$
 So $(W_0)_A = 2.25 \text{ eV}$
 $(K.E.)_A = 2 \text{ eV}$
 $(K.E.)_B = 0.5 \text{ eV}$

5. number of revolutions per second

$$= \frac{v}{2\pi r} = \frac{2.18 \times 10^6 \left(\frac{Z}{n}\right)}{2 \times 3.14 \times 0.529 \times \left(\frac{n^2}{Z}\right) \times 10^{-10}} = \frac{2.18 \times 10^6 \left(\frac{1}{2}\right)}{2 \times 3.14 \times 0.529 \times \left(\frac{2^2}{1}\right) \times 10^{-10}}$$

$$\text{Number of revolution in } 10^{-8} \text{ second} = \frac{2.18 \times 10^6 \left(\frac{1}{2}\right)}{2 \times 3.14 \times 0.529 \times \left(\frac{2^2}{1}\right) \times 10^{-10}} \times 10^{-8} = 8.2 \times 10^6$$

6. The ionisation energy of He^+ is $19.6 \times 10^{-18} \text{ J}$.

\therefore Energy of the first orbit of $\text{He}^+ (Z = 2) = 19.6 \times 10^{-18} \text{ J}$.

\therefore Energy of the first orbit of $\text{H}^+ (Z = 1) = \frac{19.6 \times 10^{-18}}{4} \text{ J}$

\therefore Energy of the first orbit of $\text{Li}^{2+} (Z = 3) = \frac{19.6 \times 10^{-18}}{4} \times 9 = 4.41 \times 10^{-17} \text{ J}$.

7. (A) Transition $n \rightarrow 6$ to $n \rightarrow \infty$ For Li^{2+} sample
 (B) Transition $n \rightarrow 1$ to $n \rightarrow 2$ For H-atom sample
 (C) Transition $n \rightarrow 1$ to $n \rightarrow 3$ For He^+ sample
 (D) Transition $n \rightarrow 1$ to $n \rightarrow \infty$ For H-atom sample

8. $\Delta E = \frac{12400}{1026} = 12.09 \text{ eV}$.

So, $\Delta E = E_3 - E_1$.

Hence, induced radiations will be correspond to following energy transition

$E_3 \rightarrow E_1$, $E_3 \rightarrow E_2$ and $E_2 \rightarrow E_1$.

9. $-13.6 \frac{Z^2}{n^2} = 4R = 4 \times 2.2 \times 10^{-18} \text{ J}$.

$$Z^2 = \frac{4 \times 2.2 \times 10^{-18} \text{ J}}{13.6 \times 1.6 \times 10^{-19}} = 4 ; \quad Z = 2.$$

$$r = 0.529 \frac{n^2}{Z} \times 10^{-10} \text{ m.} \quad r = 0.529 \times 10^{-10} \times \frac{1}{2} = 2.645 \times 10^{-11} \text{ m.}$$

DPP No. # 17

1. $Z = 2 \quad n_1 = 2 \quad n_2 = \infty$

$$\bar{\nu} = R(2)^2 \left(\frac{1}{2^2} - \frac{1}{\infty^2} \right) = R$$

2. $h\nu_1 = 13.6 \text{ eV}$

$$h\nu_2 = 13.6 \times 2^2 \text{ eV}$$

$$h\nu_3 = 13.6 \times 2^2 \times \frac{3}{4} \text{ eV}$$

$$\Rightarrow h\nu_2 = h\nu_1 + h\nu_3$$

$$\Rightarrow \nu_2 = \nu_1 + \nu_3$$

3. (i) Series limit of Lyman series $\Rightarrow n = \infty$ to $n = 1$.

(ii) Series limit of Balmer series $\Rightarrow n = \infty$ to $n = 2$.

$$E_{n=2 \text{ to } n=1} = E_{n=\infty \text{ to } n=1} - E_{n=\infty \text{ to } n=2}$$

$$\frac{hc}{\lambda} = \frac{hc}{\lambda_1} - \frac{hc}{\lambda_2}$$

$$\frac{1}{\lambda} = \frac{1}{\lambda_1} - \frac{1}{\lambda_2} \quad \Rightarrow \quad \lambda = \frac{\lambda_1 \lambda_2}{\lambda_2 - \lambda_1}$$

4. Both the photons will not be absorbed by the electron of H-atom as the energy levels are quantised.

$$\text{Sum of energies of both photons} = \frac{12400}{1240} + \frac{12400}{2000} = 10 + 6.2 = 16.2 \text{ eV} > (IE)_H$$

5. (A) Only first four spectral lines belonging to Balmer series in hydrogen spectrum lie in visible region.

(B) If a light of frequency ν falls on a metal surface having work functional $h\nu_0$, photoelectric effect will take place only if $\nu \geq \nu_0$, since ν_0 is the minimum frequency required for photoelectric effect.

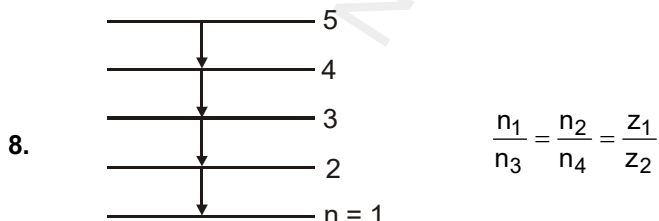
6. $\frac{\Delta n(\Delta n + 1)}{2} = 15$

$$\Rightarrow \Delta n = 5 \quad \Rightarrow n - 2 = 5 \quad \Rightarrow n = 7$$

7. $\bar{\nu}_1 = R \times 3^2 \left(\frac{1}{2^2} - \frac{1}{3^2} \right) = \frac{5R}{4}$

$$\bar{\nu}_2 = R \times \frac{3^2}{3^2} = R$$

$$\bar{\nu}_2 - \bar{\nu}_1 = \frac{5R}{4} - R = \frac{R}{4}$$



Clearly 2nd lowest energy is $4 \rightarrow 3$ transition
 hence transition is Li^{2+} having same energy is $9 \rightarrow 12$

9. (A) $6 \rightarrow 3 \quad \Delta n = 3$

$$\therefore \text{no. of lines} = \frac{3(3+1)}{2} = 6.$$

All lines are in infrared region

(B) $7 \rightarrow 3 \quad \Delta n = 4$

\therefore no. of lines = $\frac{4(4+1)}{2} = 10.$

All lines are in infrared region

(C) $5 \rightarrow 2 \quad \Delta n = 3$

no. of lines = $\frac{3(3+1)}{2} = 6.$

All lines are in visible region

(D) $6 \rightarrow 2 \quad \Delta n = 4$

no. of lines = $\frac{4(4+1)}{2} = 10.$

All lines are in visible region.

10. $v = RcZ^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$

For $2 \rightarrow 1$ transition in H-atom sample, $v = Rc(1)^2 \left[\frac{1}{1^2} - \frac{1}{2^2} \right] = \frac{3Rc}{4}$

$\therefore (H)_{2 \rightarrow 1} = (He^+)_{4 \rightarrow 2} = (Li^{2+})_{6 \rightarrow 3}$

Thus, given photon is not emitted from $8 \rightarrow 3$ transition in He^+ ion sample.

DPP No. # 18

- Total spectral lines obtained from H-atom = 6
 Total spectral lines obtained from He^+ -ion = 6
 One line is common between them so total number of lines are 11.

- Balmer series lines lies in visible region.

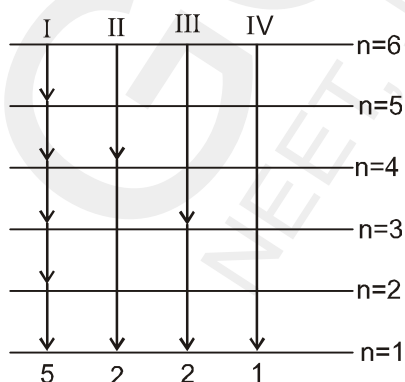
- $n_2 \rightarrow n_1$, max different spectral lines = 10

$\therefore \Delta n = n_2 - n_1 = 4$

\therefore change in angular momentum = $(\Delta n) \frac{h}{2\pi} = 4 \left(\frac{h}{2\pi} \right) = 8 \left(\frac{h}{4\pi} \right)$

$\therefore y = 8$

- $(Li^{2+})_{12 \rightarrow 3} = (H)_{4 \rightarrow 1}$
 \therefore No. of lines in infrared region = 1 ($4 \rightarrow 3$) paschen series



- Minimum number of atoms required = 4

- Let excited state be n.
Case - I : There is a transition to first excited state i.e. 2nd level from n^{th} level.

$10.20 + 17.00 = 13.6 Z^2 \left[\frac{1}{2^2} - \frac{1}{n^2} \right] \dots (1)$

- Case - II** : There is a transition to second excited state i.e. 3rd level from n^{th} level.

$$4.25 + 5.95 = 13.6 Z^2 \left[\frac{1}{3^2} - \frac{1}{n^2} \right] \quad \dots (2)$$

on dividing (1) to (2), we have n^{th} level is = 6.

So, excited state is 5th.

So, $n = 5$.

$$7. \quad n\lambda = 2\pi r \quad \Rightarrow \quad \text{so} \quad \lambda = \frac{2\pi r}{3} = \frac{2\pi}{3} \times (53 \text{ pm}) \times \frac{9}{2} \approx 5\text{\AA}$$

8. Use formula $2\pi r_n = n\lambda$

We can't apply Bohr radius formula for Be^{2+}

$$2\pi r_n = n\lambda \quad \text{for } n=2, \lambda = 2.5\text{\AA}$$

$$9. \quad \frac{4}{n} = \frac{6}{3} \Rightarrow n = 2 \text{ electron is present in } 2^{\text{nd}} \text{ orbit of } \text{Be}^{3+}. (\text{Be}^{3+} \text{ has } 1s^2)$$

$$2\pi r = 2\lambda \quad \Rightarrow \quad \lambda = \pi r \quad \Rightarrow \quad r = 0.529 \times 10^{-10} \times \frac{2^2}{4} = 0.529 \times 10^{-10} = 0.529\text{\AA}$$

DPP No. # 19

1. Only Spin quantum number (s) is not derived from Schrodinger wave equation.

5. number of electrons in subshells = $2(2l + 1)$

7. For $n = 8$ to $n = 6$, energy difference is minimum and $\lambda \propto \frac{1}{\text{Energy}}$

8. S_1 : Photoelectric effect can be explained on the basis of particle nature of electromagnetic radiations.

S_2 : $n = 2, \ell = 1 \therefore$ 2p-orbital \therefore dumb-bell shaped.

S_3 : d_{xy} orbital has its lobes directed at an angle of 45° from X-axis and Y-axis. So, it has zero probability of finding electrons along X-axis and Y-axis.

9. S_1 : Angular momentum = $mvr = n \left(\frac{h}{2\pi} \right) \therefore$ Angular momentum $\propto n$.

S_2 : An orbital can only accommodate 2 electrons with opposite spin.

S_3 : s-orbital is non-directional in nature, rest all orbitals are directional.

DPP No. # 20

1. $n = 4, m = -3 \therefore$ only possible value of ℓ is 3.

$$\therefore \text{Orbital angular momentum} = \sqrt{\ell(\ell+1)} \frac{h}{2\pi} = \frac{2\sqrt{3}h}{2\pi} = \frac{\sqrt{3}h}{\pi}$$

2. $Z = 26 \rightarrow [\text{Ar}]4s^2 3d^6$

$$\sqrt{n(n+2)} = \sqrt{24} \quad \Rightarrow \quad n = 4$$

In d orbital number of unpaired electron = 4, but element have charge so 4s electron have to be removed hence $n+ = 2$.

3. V ($Z = 23$), $[\text{Ar}] 4s^2 3d^3$ unpaired electron = 3 ;

Cr ($Z = 24$), $[\text{Ar}] 4s^1 3d^5$ unpaired electron = 6

Mn ($Z = 25$), $[\text{Ar}] 4s^2 3d^5$ unpaired electron = 5

4. For $n = 4, \ell \neq 4$, for $\ell = 3, m \neq 4$

5. Total spin = 3 $\Rightarrow \frac{n}{2} = 3 \quad \Rightarrow \quad n = 6$

$$P \times V = P_2 \times \left(V - \frac{5V}{100} \right); P_2 = \frac{100}{95} P \Rightarrow \therefore P_2 = 1.0526 P$$

$$\therefore \text{Increase in } P = 0.0526 \Rightarrow \therefore \% \text{ increase in } P = 0.0526 \times 100 = 5.26 \text{ Ans.}$$

DPP No. # 24

2. $P_{\text{gas}} = 76 - 45 = 31 \text{ cm of Hg}$

3. $x = 6 \text{ cm}$

4. $\approx 101.3 \text{ cm.}$

5. $x = 26.84 \text{ cm}$

6. $(75 + 15) \rho g \times 15A = 75\rho g \times hA$
 $\therefore h = 18 \text{ cm Ans.}$

7. 550 cm

8. 19 cm.

DPP No. # 25

5. 25 mL.

6. 273°C.

7. Suppose at $T = 27^\circ\text{C} = 300 \text{ K}$ $T_1 = 37^\circ\text{C} = 310 \text{ K}$
 $V = 1 \text{ litre}$ $V_1 = ?$

at constant pressure $\frac{V}{T} = \frac{V_1}{T_1}$

$$\frac{1}{300} = \frac{V_1}{310}$$

$$V_1 = \frac{310}{300} = 1.0333 \text{ litre}$$

Since, capacity of flask is 1 litre.

$$\therefore \text{Volume of air escaped out} = 1.0333 - 1 = 0.0333 \text{ litre} = 33.3 \text{ mL Ans.}$$

8. (a) No, (b) 55°C.

9. (a) 50.5 cm (b) 55 cm (c) 45 cm.

DPP No. # 26

3. (A) Temperature should be increased continuously.

4. At $T_1 = 300 \text{ K}$, mole of air = n_1 ; At $T_2 = 750 \text{ K}$, mole of air = n_2
 \therefore at constant P, V $n_1 T_1 = n_2 T_2$; $\therefore n_1 \times 300 = n_2 \times 750$

or $n_2 = \frac{300}{750} \times n_1$; or $n_2 = 0.4 n_1$

$$\therefore \text{moles of air escaped out} = n_1 - n_2 = n_1 - 0.4 n_1 = 0.6 n_1 \text{ or fraction of air escaped out} = 0.6 \text{ Ans.}$$

5. -23°C

6. Given, initially $V_2 = \frac{300}{1000} \text{ litre}$, $P_2 = \frac{684}{760} \text{ atm}$, $T_2 = 300 \text{ K}$

At STP $V_1 = ?$, $P_1 = 1 \text{ atm}$, $T_1 = 273 \text{ K}$

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

$$V_1 = 0.2457 \text{ litre}$$

$$\therefore \text{Volume (V) at STP} = 245.7 \text{ mL.}$$

7. (a) $1 : 3$ (b) 12.3 litre

8. Let, vol of containers be V & temp be T
 $P_1 = 100 \text{ mm}$ $P_2 = 400 \text{ mm}$

$$\therefore n_1 = \frac{P_1 V}{RT} \quad \& \quad n_2 = \frac{P_2 V}{RT}$$

$$\therefore n_1 + n_2 = \frac{(P_1 + P_2) \times V}{RT}$$

After joining two containers final vol = (V+V) = 2V(for gases)

$$\therefore P_{\text{final}} = \frac{(n_1 + n_2)RT}{V_{\text{final}}} = \frac{(P_1 + P_2) \times V}{RT} \times \frac{RT}{2V} = \frac{(P_1 + P_2)}{2}$$

$$= \frac{(100 + 400)\text{mm}}{2} = 250 \text{ mm.}$$

DPP No. # 27

9. Volume of Ist gas = 3 × 22.4 = 67.2 L
 Volume of IInd gas = 2 × 22.4 = 44.8 L
 Volume of IIIrd gas = 4 × 22.4 = 89.6 L
 So, order of volume will be III > I > II

10. PV = nRT
 3.06 × 1 = n × 0.0821 × 373
 n = 0.1, mass of H₂O_(vap) = 1.8 g
 ⇒ Volume of H₂O_(l) = 1.8 mL

11. (A) 1 bar ≈ 1 atm = 760 torr
 (B) T (in K) = T (in °C) + 273
 (C) 1 m³ = 10⁶ mL

12. PV = nRT
 For equal pressure and volume,

$$n_{\text{H}_2} \propto \frac{1}{T}$$

If the temperature in flask A is greater than in flask B, then flask B contains greater number of moles of H₂ gas than flask A.

DPP No. # 28

6. Finally, the ratio of moles of gas in the 2 flasks is the ratio of the partial pressure of gas in the two flasks.

$$\therefore \frac{n_1}{n_2} = \frac{T_2}{T_1} = \frac{400}{320} = \frac{5}{4}$$

7. 88.67 cm of Hg

8. No of moles present initially = No of moles present finally

$$\therefore \frac{7 \times 5}{R \times 600} = \frac{P \times 5}{R \times 600} + \frac{P \times 2.5}{R \times 400}$$

on solving, P = 4 atm **Ans.** 4 atm

9. After the opening of the stop cock the pressure of the each bulb will remain same.

At the beginning, the no. of moles of gas in A = $\frac{10 \times 4}{RT}$

At the beginning, the no. of moles of gas in B = $\frac{6.25 \times 8}{RT}$

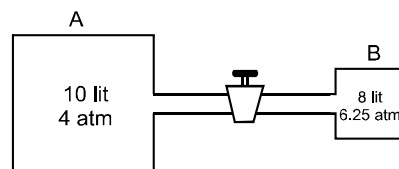
∴ total no. of mole at the beginning = $\frac{90}{RT}$

Total no. of mole of gas before opening the stop cock

= total no. of moles of gas after opening stop cock = $\frac{90}{RT}$

∴ pressure after the opening of the stop cock

$$P = \frac{90}{RT} \times \frac{RT}{V_{\text{total}}} = \frac{90}{10+8} = 5 \text{ atm}$$



DPP No. # 29

1. Let the mass of SO₂ and oxygen be m g. Mole fraction of SO₂, X_{SO₂}

$$= \frac{\frac{m}{64}}{\frac{m}{64} + \frac{m}{32}} = \frac{m}{32} \times \frac{32}{3m} = \frac{1}{3}$$

Let the total pressure be P.

$$\therefore \text{Partial pressure of SO}_2, P_{\text{SO}_2} = P \times X_{\text{SO}_2} \quad P \times \frac{1}{3} = \frac{1}{3} P.$$

3. $n_T = n_1 + n_2 + n_3 + \dots$

$$\frac{P_T \cdot V_T}{RT} = \frac{P_1 V_1}{RT} + \frac{P_2 V_2}{RT} + \dots = \sum P_i V_i$$

$$P_T V_T = \sum P_i V_i$$

$$= 2PV + \frac{P \cdot V}{2} + \frac{P}{2} \cdot \frac{P}{4} + \frac{P}{4} \cdot \frac{V}{8} + \dots$$

$$= 2PV \left[1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \dots \right]$$

$$P_T V_T = 2PV \frac{1}{1 - \frac{1}{4}} = 2PV \cdot \frac{4}{3}$$

$$V_T = V_1 + V_2 + V_3 + \dots$$

$$= V + \frac{V}{2} + \frac{V}{4} + \frac{V}{8} + \dots$$

$$= V \left[1 + \frac{1}{2} + \dots \right] = V \frac{1}{1 - \frac{1}{2}} = 2V$$

$$\therefore P_T \cdot 2V = 2PV \cdot \frac{4}{3}$$

$$P_T = \frac{4}{3} P$$

4. 0.28 atm

5. Mole of A = $\frac{0.60}{60} = 0.01$; Mole of B = $\frac{0.20}{40} = 0.005$; Total mole = 0.015

Total pressure = 750 mm ; Partial pressure of A = $\frac{\text{mole of A}}{\text{total moles}} \times \text{total pressure}$

$$= \frac{0.01}{0.015} \times 750 = 500 \text{ mm} ; \text{ Partial pressure of B} = \frac{0.005}{0.015} \times 750 = 250 \text{ mm}$$

6. $M_{\text{balloon}} + M_{\text{gas}} + M_{\text{payload}} = M_{\text{air displaced}}$

$$100 + \frac{\frac{4}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3 \times 1000 \times 5}{\frac{1}{12} \times 441} \times \frac{4}{1000} + M_{\text{payload}} = \frac{4}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3 \times \frac{14}{11}$$

on solving, $M_{\text{payload}} = 3434 \text{ kg}$

7. (D) Weight of $\text{H}_2 = 20 \text{ g}$ in 100 g mixture ; Weight of $\text{O}_2 = 80 \text{ g}$

$$\therefore \text{Moles of H}_2 = \frac{20}{2} = 10 ; \quad \therefore \text{Moles of O}_2 = \frac{80}{32} = \frac{5}{2}$$

$$\therefore \text{Total moles} = 10 + \frac{5}{2} = \frac{25}{2}$$

$$\therefore P_{\text{H}_2} = P_T \times \text{mole fraction of H}_2 = 1 \times \frac{10}{25/2} = 0.8 \text{ bar}$$

8. $\frac{20 + w_{\text{H}_2}}{11} = 2 \quad \Rightarrow \quad w_{\text{H}_2} = 2 \text{ g.}$

$$M_{\text{avg}} = \frac{20 + 2}{\frac{20}{20} + \frac{2}{2}} = 11.$$

DPP No. # 30

1. $d = \frac{PM}{RT} \quad \therefore 2.5 = \frac{2 \times M_{\text{gas}}}{0.082 \times 546} \quad \therefore M_{\text{gas}} = 56$
 \therefore Both (A) & (C) options are correct.

5. Rate of diffusion of He = $\frac{5\text{mL}}{15} = 5\text{ml/s} = r_{\text{He}}$ (say)

$$\therefore r_{\text{SO}_2} = r_{\text{He}} \times \frac{1}{4} = 5\text{ml/s} \times \frac{1}{4}$$

\therefore Volume of SO_2 diffused in 2.0 seconds

$$= \frac{5}{4} \times 2 \text{ ml} = \mathbf{2.5 \text{ ml Ans.}}$$

7. $\frac{r_{A_2}}{r_{B_2}} = \frac{P_{A_2}}{P_{B_2}} \sqrt{\frac{VD_{B_2}}{VD_{A_2}}}$

$$\frac{60 / \Delta t}{40 / \Delta t} = \frac{1}{P} \sqrt{\frac{10}{40}}$$

$$P = \frac{1}{3} \text{ atm}$$

8. Rate of diffusion of He = r_1
 rate of diffusion of $\text{CH}_4 = r_2$

$$\frac{r_1}{r_2} = \frac{n_1}{n_2} \sqrt{\frac{M_2}{M_1}} = \frac{2}{1} \sqrt{\frac{16}{4}} = \frac{4}{1}$$

$$\text{Diffused mole of He} = \frac{4}{5} \times 100 = 80\%$$

$$\text{Diffused mole of CH}_4 = \frac{1}{5} \times 100 = 20\%$$

9. 39/46

DPP No. # 31

1. $\frac{n_A / t}{n_B / t} = \frac{P_A}{P_B} \sqrt{\frac{M_B}{M_A}}$

$$\frac{n_1 M_1 + n_2 M_2}{x_1 + x_2} = M_{\text{mix}}$$

$$X_1 M_1 + (1 - X_1) M_2 = M_{\text{mix}}$$

$$\Rightarrow X_1 = \frac{2}{5}, X_2 = \frac{3}{5}$$

$$\Rightarrow \frac{x_A}{x_B} = \frac{2}{3} \sqrt{\frac{72}{128}} = \frac{1}{2}$$

$$\Rightarrow X_A = \frac{1}{3}, X_B = \frac{2}{3}$$

2. Initially $r_A = \frac{1000 - 900}{5} = 20 \text{ torr/s}$

In the mix.

$$M_{\text{mix}} = X_A M_A + (1 - X_A) M_B$$

$$\Rightarrow \frac{472}{5} = X_A \times 128 + (1 - X_A) 72 \quad ;$$

$$\frac{472}{5} = 56X_A + 72$$

$$472 = 280X_A + 360 \quad ;$$

$$X_A = \frac{112}{280} = \frac{2}{5}, X_B = \frac{3}{5}$$

The mix.

$$\frac{r_A}{r'_A} = \frac{P_A \cdot A_1'}{P_A A_2} \quad ;$$

$$\frac{r_A}{r'_A} = \frac{1}{2} \times \frac{x^2}{x \times \frac{3x}{2}} = \frac{1}{3}$$

$$r'_A = 3r_A = 3 \times 20 = 60 \text{ torr/s} \quad ;$$

$$\frac{r'_A}{r'_B} = \frac{P_A}{P_B} \sqrt{\frac{M_B}{M_A}} = \frac{2}{3} \times \sqrt{\frac{72}{128}} = \frac{1}{2}$$

$$r'_B = 120 \text{ torr/s}$$

After 10 sec

$$P_A'' = 2000 - 60 \times 10 = 1400 \text{ torr} \quad ;$$

$$P_B'' = 3000 - 120 \times 10 = 1800 \text{ torr}$$

$$\frac{n_A}{n_B} = \frac{7}{9}$$

3. $2000 - 60t = 3000 - 120t$

$$60t = 1000 \quad \Rightarrow \quad t = \frac{50}{3} \text{ sec.}$$

6. $\frac{r_{\text{mix}}}{r_{D_2}} = \frac{r_{He} + r_{SO_2}}{r_{D_2}} = \frac{r_{He}}{r_{D_2}} + \frac{r_{SO_2}}{r_{D_2}} = \frac{P_{He}}{P_{D_2}} \sqrt{\frac{M_{D_2}}{M_{He}}} + \frac{P_{SO_2}}{P_{D_2}} \sqrt{\frac{M_{D_2}}{M_{SO_2}}}$

$$\therefore \frac{r_{\text{mix}}}{r_{D_2}} = \frac{0.8}{1} \sqrt{\frac{4}{4}} + \frac{0.2}{1} \sqrt{\frac{4}{64}} = 0.8 + \frac{0.4}{8} = 0.85$$

7. $\text{K.E.} = \frac{1}{2} M \bar{C}^2$

Now for the helium atom, $\text{K.E.} = \frac{1}{2} M_{He} \bar{C}^2 = \frac{1}{2} M_{He} \times \frac{3RT}{M_{He}} = \frac{3}{2} RT$;

Again for H_2 molecules; $\text{KE} = \frac{1}{2} M_{H_2} \bar{C}^2 = \frac{1}{2} \times M_{H_2} \times \frac{3RT}{M_{H_2}} = \frac{3}{2} RT$

\therefore K.E. of H_2 molecules is same as it is for H_2 molecules.