DPP # 10

1. **(A)**

Sol. $M_{avg} = \dfrac{a(16)+b(28)}{a+b} = 20$

$16a + 28b = 20a + 20b$

$8b = 4a$

$\dfrac{a}{b} = 2$

$M'_{avg} = \dfrac{16(b)+28(a)}{a+b}$

$= \dfrac{16+28\frac{a}{b}}{1+\frac{a}{b}} = \dfrac{16+56}{3}$

$= \dfrac{72}{3} = 24$

2. **(C)**

Sol. $P_4 + 3O_2 \longrightarrow P_4O_6$

$\dfrac{x}{31\times4} \qquad \dfrac{y}{32}$

$P_4 + 5O_2 \longrightarrow P_4O_{10}$

$\dfrac{12.4-x}{31\times4} \qquad \dfrac{12.8-4}{32}$

In both the reactions P_4 & O_2 are limiting.

$\dfrac{1}{\left(\frac{x}{31\times4}\right)} = \dfrac{\quad}{\left(\frac{\quad}{32}\right)}$ …… (1)

$\dfrac{1}{\left(\frac{12.4-x}{31\times4}\right)} = \dfrac{\quad}{\left(\frac{12.8 \quad y}{32}\right)}$ …… (2)

On solving (1) & (2)

$x = 6.2$ gm

$y = 4.8$ gm

Moles of $P_4O_6 = \dfrac{x}{31\times4} = \dfrac{6.2}{31 \quad 4} = 0.05$

Mole of $P_4O_{10} = \dfrac{12.4-x}{31 \quad 4} = \dfrac{6.2}{31\times4} = 0.05$

3. **(C)**

Sol. Given

$1\text{ ml} \longrightarrow 1.2\text{ gram}$

$2\text{ ml} \longrightarrow 2.4\text{ gram}$

$35\text{ drops} \longrightarrow 2.4\text{ gram}$

$35\text{ drops} \longrightarrow \frac{2.4}{70}\text{ mole}$

$35\text{ drops} \longrightarrow \frac{2.4}{70} \times N_A\text{ molecule}$

$1\text{ drop} \longrightarrow \frac{2.4}{70} \times \frac{N_A}{35}\text{ molecule}$

$= \frac{1.2}{(35)^2} N_A\text{ molecule}$

4. **(A)**

Sol. Let the formula be FeO_x

Then $\frac{16x}{M} = \frac{32}{100}$

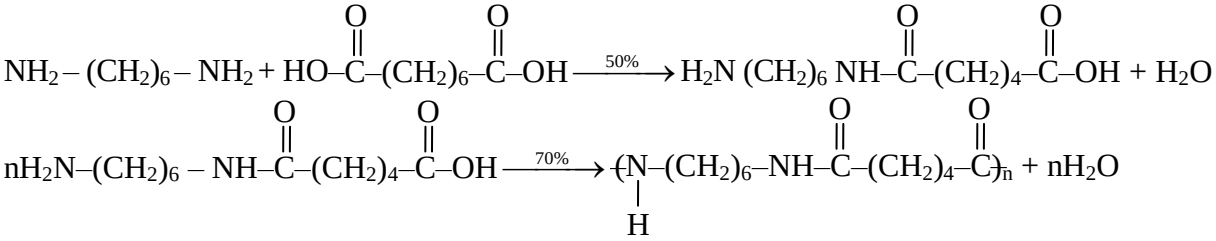
$\Rightarrow \quad \frac{16x}{56+16x} = \frac{32}{100}$

$x \simeq \frac{3}{2}$

$FeO_x \Rightarrow FeO_{\frac{3}{2}} \Rightarrow Fe_2O_3$

5. **(B,D)**

Sol.



(A) Moles of Hexamethylenediamine $= \frac{290}{116}$

Moles of dimer $= \frac{290}{116} \times \frac{50}{100}$

Mass of dimer $= \frac{290}{116} \times \frac{50}{100} \times 244 = 305\text{ gm}$

(B) Moles of adipic acid $= \frac{730}{146} = 5$

Moles of dimer $= 5 \times \frac{50}{100} = 2.5$

Mass of dimer $= 2.5 \times 244 = 610\text{ gm}$

(C) Moles of dimer $= \frac{1220}{244} = 5$

Moles of Nylon-6,6 $= 5 \times \frac{70}{100} \times \frac{1}{n}$

Mass of Nylon-6,6 $= 5 \times \frac{70}{100} \times \frac{1}{n} \times 226\ n$

$= 791$ gm

(D) Moles of dimer $= \frac{1742}{244}$

Mass of Nylon-6,6 $= \frac{1742}{244} \times \frac{70}{100} \times \frac{1}{n} \times 226n$

$= 1.13$ kg

6. (A,B,D)

Sol. **(A)**

	N_2	+	$2H_2$	$\longrightarrow$	N_2H_4
n_i	2		2		0
n_f	1		0		1

(B)

	N_2	+	$2H_2$	$\longrightarrow$	N_2H_4
n_i	1		2		0
n_f	–		–		1

	N_2	+	$3H_2$	$\rightleftharpoons$	$2\ NH_3$
n_i	2		6		0
n_f	–		–		4

(C)

	N_2	+	$2H_2$	$\longrightarrow$	N_2H_4
n_i	4		8		
n_f					4

	N_2	+	$3H_2$	$\longrightarrow$	$2\ NH_3$
n_i	0		1		0

(D)

	N_2	+	$3H_2$	$\longrightarrow$	$2\ NH_3$
n_i	0.5		3		
n_f	–		1.5		1

	N_2	+	$2H_2$	$\longrightarrow$	N_2H_4
n_i	0		1.5		

7. (i) (C)

(ii) (A)

Sol. (i) $2\ FeSO_{4(s)} \longrightarrow Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$

n_i $\frac{7.6}{152}$ mole $= 0.05$

n_f $\frac{0.05}{2}$ $\frac{0.05}{2}$ $\frac{0.05}{2}$

total moles of gases $= \frac{0.05}{2} + \frac{0.05}{2}$

$= 0.05$

volume of gases $= 0.05 \times 22.4$

$= 1.12$ lit

(ii) M_{avg} $\Downarrow$ (gaseous mixture) $= \frac{n_{SO_2} \times M_{SO_2} + n_{SO_2} \times M_{SO_3}}{n_{SO_2} + n_{SO_3}}$

$= \frac{\frac{0.05}{2} \times 64 + \frac{0.05}{2} \times 80}{0.05} = 72$

8. A - P, R ; B - Q, R ; C - Q, S ; D - Q, R

Sol. Let Moles of Isotope I= a mole

Moles of Isotope II = b mole

(A) $M_{avg} = \frac{a(z-1)+b(z+2)}{a+b}$

$z = \frac{z(a+b)-a+2b}{(a+b)}$

$a = 2b$

$\frac{a}{b} = 2$

$\frac{a}{a+b} = \frac{2}{3} = 66.66\%$

b is heavier isotope = 33.33%

(B) $z + 2 = \frac{a(z+1)+b(z+3)}{a+b}$

$z + 2 = \frac{z(a+b)+a+3b}{a+b}$

$2a + 2b = a + 3b$

$a = b$

% b = 50%

(C) $2z = \frac{a(z)+b(3z)}{a+b}$

$2z\,(a + b) = z\,(a + 3b)$

$a = b$

% b = 50%

(D) $z = \frac{a(z-1)+b(z+1)}{a+b}$

$a = b$

% b = 50%

9. **8, 2**

Sol. Let % O^{17} = x %

Then % O^{18} = (10 – x) %

$$M_{avg} = 16.12 = \frac{90(16)+x(17)+(10-x)18}{90+x+(10-x)}$$

1612 = 1440 + 180 – x

x = 8

% O^{17} = x = 8%

% O^{18} = 10 – x = 2%

10. **7**

Sol. Let moles of Cl^{34} = a mole

& Cl^{38} = b moles

$$M_{avg} = 35 = \frac{a(34)+b(38)}{a+b}$$

a = 3b

% a = 75% moles

% b = 25% moles

Moles of $Cl^{35} = \frac{7}{35} = \frac{1}{5}$ = 0.2 moles

In	Cl^{35}	p = 17
	(1 atom)	n = 18
In	1mole Cl^{35}	p = 17 moles
		n = 18 moles
In	0.2 mole Cl^{35}	p = 17 × 0.2 moles
Sum of moles of (p + n)	=	0.2 × 17 + 0.2 × 18
	=	0.2 (35)
	=	7 moles