# Tutorial - 1

## Answers

1. (a) Mechanism of radical polymerization
   (b) Mechanism of cationic polymerization
   (c) Mechanism of anionic polymerization.

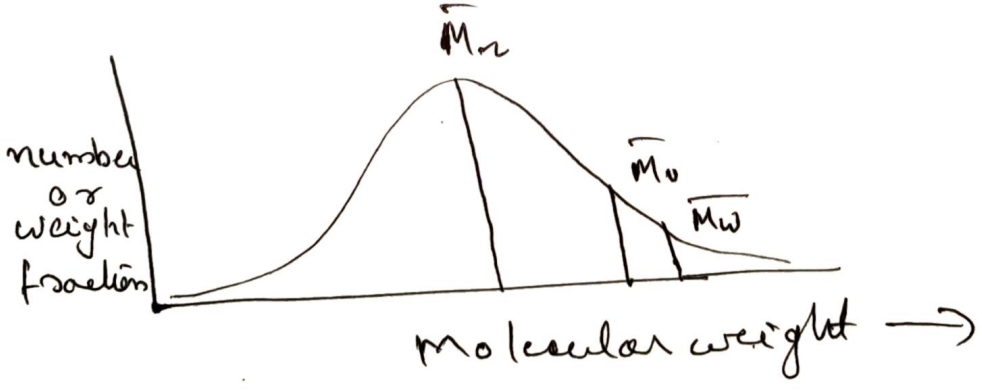
2. $R_p = k_p \left(\frac{f k_i}{k_t}\right)^{1/2} [I]^{1/2} [M]$

   $\lambda$ = kinetic chain length = $\frac{k_p}{2} \left(f k_i k_t\right)^{-1/2} [I]^{+1/2} [M]$

   $\bar{D}_p$ = kinetic chain length (if termination is by disproportionation.

   $\bar{D}_p$ = 2 × kinetic chain length (if termination is by coupling)

3. Because of polydispersity of polymer samples. Explain $\bar{M}_n$, $\bar{M}_w$ & $\bar{M}_v$

4. 


5) Explain based on Expressions for $R_p$ and $\bar{D}_p$ (Refer answer to Q 2)

6) Lead to branching and result in LDPE → write chain transfer mechanism leading to LDPE

7) $R_p = k_p \left(\frac{f k_i}{k_t}\right)^{1/2} [M] [I]^{1/2}$

$= 367 \left(\frac{0.7 \times 4.5 \times 10^{-6}}{9.5 \times 10^{6}}\right)^{1/2} \left(\frac{300}{104}\right) \times \left(\frac{1.64 \times 10^{-2}}{164 \times 10^{2}}\right)^{1/2}$

$= \underline{\underline{6 \times 10^{-6} \ Ms^{-1}}}$

$\bar{D}_p = k_p \left(f k_i k_t\right)^{-1/2} [M] [I]^{-1/2}$

$= 367 \left(0.7 \times 4.5 \times 10^{-6} \times 9.5 \times 10^{6}\right)^{-1/2} \times 2.88 \times (10^{-4})^{-1/2}$

$= \underline{\underline{19573}}$

$\bar{M}_n = \underline{\underline{19573 \times 104}}$

8) $\bar{M}_w = 0.1 \times 12{,}000, 0.19 \times 21{,}000 + 0.24 \times 35{,}000, +$
$0.18 \times 49{,}000 + 0.11 \times 73{,}000 + 0.08 \times 102{,}000$
$+ 0.06 \times 122{,}000 + 0.04 \times 146{,}000$
$= \underline{\underline{50\,680}}$ g mol$^{-1}$

$\bar{M}_n = \cancel{0 \times 12{,}000}$

$$\frac{\frac{0.1}{12{,}000} \times 12{,}000 + \frac{0.19}{21{,}000} \times 21{,}000 + \frac{0.24}{35{,}000} \times 35{,}000 + \ldots}{\frac{0.1}{12{,}000} + \frac{0.19}{21{,}000} + \frac{0.24}{35{,}000} + \frac{0.18}{49{,}000} + \frac{0.11}{73{,}000} + \frac{0.08}{102{,}000} + \ldots}$$

$$= \frac{1}{\frac{0.1}{12{,}000} + \frac{0.19}{21{,}000} + \frac{0.24}{35{,}000} + \frac{0.18}{49{,}000} + \frac{0.11}{73{,}000} + \frac{0.08}{102{,}000} + \frac{0.06}{122{,}000} + \frac{0.04}{146{,}000}}$$

$= \underline{\underline{32322}}$ g mol$^{-1}$

9) Radioactivity of polymer sample
$= 6 \times 10^9$ counts s$^{-1}$ mol
$\equiv$ equivalent to 1 mol of AIBN
Hence termination is by coupling.