

Q. A polymer has the following composition: 100 molecules of molecular mass 1000, 200 molecules of molecular mass 2000 and 500 molecules of molecular mass 5000. Calculate the no. and weight average & polydispersity index.

$$M_1 = 1000 \text{ g/mol}$$

$$M_2 = 2000 \text{ g/mol}$$

$$M_3 = 5000 \text{ g/mol}$$

$$N_1 = 100$$

$$N_2 = 200$$

$$N_3 = 500$$

Number average $\rightarrow \bar{M}_n = \frac{\sum N_i M_i}{\sum N_i} = \frac{100 \times 1000 + 200 \times 2000 + 500 \times 5000}{100 + 200 + 500}$

$$= \frac{100 \times 10^3 + 200 \times 2 \times 10^3 + 500 \times 5 \times 10^3}{100 + 200 + 500}$$

$$= \frac{100 \times 10^3 + 400 \times 10^3 + 2500 \times 10^3}{800}$$

Weight Average $M_w = \frac{100 \times (1000)^2 + 200 \times (2000)^2 + 500 \times (5000)^2}{100 \times 1000 + 200 \times 2000 + 500 \times 5000}$

$$= \frac{100 \times 10^6 + 200 \times 4 \times 10^6 + 500 \times 25 \times 10^6}{3000 \times 10^3}$$

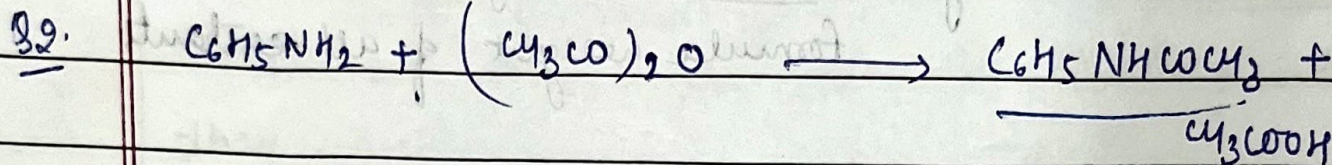
$$= \frac{100 \times 10^6 + 800 \times 10^6 + 12500 \times 10^6}{3000 \times 10^3}$$

$$= 4.46 \times 10^3$$

$$PDI = \frac{4.46 \times 10^3}{3.75 \times 10^3} = 1.19$$

Polydispersity index

$$= \frac{4.46 \times 10^3}{3.75 \times 10^3}$$



Aniline acetic anhydride acetanilide.

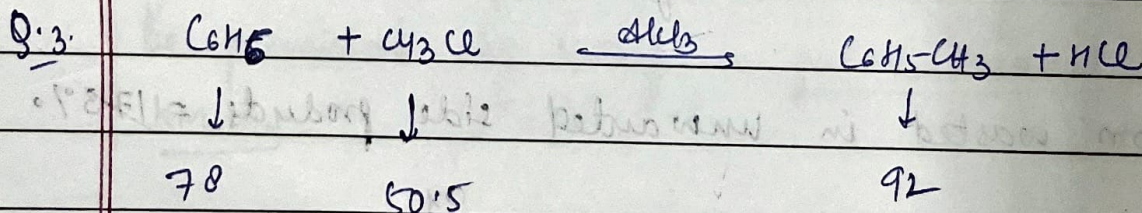
$$\frac{\text{C}_6\text{H}_5\text{NHCOCH}_3}{\text{C}_6\text{H}_5\text{NH}_2} = \frac{135}{93}$$

$$(\text{CH}_3\text{CO})_2\text{O} = 102$$

$$\% \text{ Atom Economy} = \frac{135}{93 + 102} \times 100$$

$$= \frac{135}{195} \times 100$$

$$= 69.23\%$$



$$\% \text{ Atom Economy} = \frac{92}{78 + 50.5} \times 100$$

$$= 71.59\%$$