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.

$M_1 = 1000$ g/mol $M_2 = 2000$ g/mol $M_3 = 5000$ g/mol

$N_1 = 100$ $N_2 = 200$ $N_3 = 500$

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

$= \frac{1 \times 10^5 + 4 \times 10^5 + 25 \times 10^5}{800}$

$= 3.75 \times 10^3$

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

$= \frac{1 \times 10^8 + 8 \times 10^8 + 125 \times 10^8}{30 \times 10^5}$

$= 4.46 \times 10^3$

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

Q2. $C_6H_5NH_2 + (CH_3CO)_2O \longrightarrow \underbrace{C_6H_5NHCOCH_3}_{} + \underbrace{CH_3COOH}_{}$

Aniline — acetic anhydride — acetanilide.

N=14
CO=28
O=35

$C_6H_5NHCOCH_3 = 135$

$C_6H_5NH_2 = 93$

$(CH_3CO)_2O = 102$

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

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

$= 69.23\%$

Q.3. $C_6H_6 + CH_3Cl \xrightarrow{AlCl_3} C_6H_5-CH_3 + HCl$

78 — 50.5 — 92

% Atom Economy $= \frac{92}{78+50.2} \times 100$

$= 71.59\%$.