

14.17 This problem asks for us to calculate the number-average molecular weight of a random poly(isobutylene-isoprene) copolymer. For the isobutylene repeat unit there are four carbon and eight hydrogen atoms. Thus, its repeat unit molecular weight is

$$\begin{aligned} m_{\text{Ib}} &= 4(A_{\text{C}}) + 8(A_{\text{H}}) \\ &= (4)(12.01 \text{ g/mol}) + (8)(1.008 \text{ g/mol}) = 56.10 \text{ g/mol} \end{aligned}$$

The isoprene repeat unit is composed of five carbon and eight hydrogen atoms. Thus, its repeat unit molecular weight is

$$\begin{aligned} m_{\text{Ip}} &= 5(A_{\text{C}}) + 8(A_{\text{H}}) \\ &= (5)(12.01 \text{ g/mol}) + (8)(1.008 \text{ g/mol}) = 68.11 \text{ g/mol} \end{aligned}$$

From Equation 14.7, the average repeat unit molecular weight is just

$$\begin{aligned} \bar{m} &= f_{\text{Ib}} m_{\text{Ib}} + f_{\text{Ip}} m_{\text{Ip}} \\ &= (0.25)(56.10 \text{ g/mol}) + (0.75)(68.11 \text{ g/mol}) = 65.11 \text{ g/mol} \end{aligned}$$

Since $DP = 1500$ (as stated in the problem), \bar{M}_n may be computed using Equation 14.6 as

$$\bar{M}_n = \bar{m} (DP) = (65.11 \text{ g/mol})(1500) = 97,700 \text{ g/mol}$$