

15.14 This problem gives us the tensile strengths and associated number-average molecular weights for two poly(methyl methacrylate) materials and then asks that we estimate the tensile strength for $\bar{M}_n = 40,000$ g/mol. Equation 15.3 cites the dependence of the tensile strength on \bar{M}_n . Thus, using the data provided in the problem statement, we may set up two simultaneous equations from which it is possible to solve for the two constants TS_∞ and A . These equations are as follows:

$$50 \text{ MPa} = TS_\infty - \frac{A}{30,000 \text{ g/mol}}$$

$$150 \text{ MPa} = TS_\infty - \frac{A}{50,000 \text{ g/mol}}$$

Thus, the values of the two constants are: $TS_\infty = 300$ MPa and $A = 7.50 \times 10^6$ MPa-g/mol. Substituting these values into Equation 15.3 for $\bar{M}_n = 40,000$ g/mol leads to

$$\begin{aligned} TS &= TS_\infty - \frac{A}{40,000 \text{ g/mol}} \\ &= 300 \text{ MPa} - \frac{7.50 \times 10^6 \text{ MPa} \cdot \text{g/mol}}{40,000 \text{ g/mol}} \\ &= 112.5 \text{ MPa} \end{aligned}$$