

National Chung Hsing University / Polymer Synthesis / Spring 2013
Homework 1

Name _____

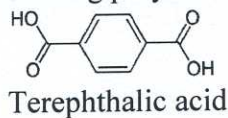
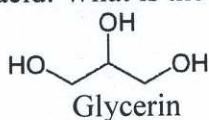
1. A glazed building weighs 1000,000 kg. 90 percent of that is a fully cured crosslinked polyester resin (the remainder is the glass reinforcing fibers, pigment, fillers, etc.). What is the molecular weight of the polymer (in g/mol)?

$$10^6 \text{ kg} \times 90\% = 9 \times 10^8 \text{ g/molecule}$$

Since it is crosslinked, $9 \times 10^8 \text{ g}$ is all one molecule.

$$\begin{aligned} \Rightarrow \text{molecular weight of the polymer} &= 9 \times 10^8 \frac{\text{g}}{\text{molecule}} \times 6.02 \times 10^{23} \frac{\text{molecule}}{\text{mol}} \\ &= 5.42 \times 10^{32} \frac{\text{g}}{\text{mol}} \# \end{aligned}$$

2. A crosslinked polymer is made by reacting (assume completely) 2 mol of glycerin with 3 mol of terephthalic acid. What is the molecular weight of the resulting polymer?



Since it is crosslinked, the polymer weight =

$$\begin{aligned} & 2 \times \left(\overset{\substack{\text{number of Carbon} \\ \swarrow}}{3} \times 12 + \overset{\substack{\text{M.W. of carbon} \\ \swarrow}}{3} \times 16 + 8 \times 1 \right) + 3 \times (8 \times 12 + 4 \times 16 + 6 \times 1) - 6 \times 18 \\ &= 184 + 498 - 108 \\ &= 574 \text{ g/molecule} \end{aligned}$$

$$\begin{aligned} \Rightarrow \text{molecular weight of the polymer} &= 574 \frac{\text{g}}{\text{molecule}} \times 6.02 \times 10^{23} \frac{\text{molecule}}{\text{mol}} \\ &= 3.46 \times 10^{26} \frac{\text{g}}{\text{mol}} \end{aligned}$$