1. Write the name and structure of the monomers needed to synthesize the following polymers.

(a) \[ \text{CH}_2\text{CHO} \] \( \text{CH}_3 \)
(b) \[ \text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CO} \]
(c) \[ \text{N(CH}_2\text{)}_5\text{CO} \]
(d) \[ \text{C}_6\text{H}_4\text{COCH}_2\text{CH}_2\text{O} \]  

(20 pts)

2. Calculate \( M_n \), \( M_w \) and the molecular weight distribution for a hypothetical polymer sample that contains equimolar amounts of polymer having molecular weights of 30,000, 60,000, and 90,000.

(15 pts)

3. What is the molecular weight of a certain polymer if a 0.50-g/L solution in a 1-cm cell exhibits an absorbance of 0.28 at 360 nm? Assume a molar absorptivity of 7800 for the repeating unit.

(15 pts)

4. Explain why steam is commonly used in ironing cotton fabrics. Also give reason why paper (almost 100% cellulose) turns “limp” in very humid weather.

(20 pts)

5. What concentration of benzoyl peroxide would be needed to polymerize a 1.00 M solution of styrene at 60 °C to a molecular weight of 125,000? Assume that termination occurs only by radical recombination, that no chain transfer occurs, and that initiator efficiency is 100% (Given: \( kp = 1.76 \times 10^2 \) L/mol-s, \( kt = 7.2 \times 10^7 \) L/mol-s, and \( kd = 1.46 \times 10^6 \) L/mol-s at 60 °C).

(15 pts)

6. Suppose you wanted to repeat the experiment given in problem 5 (using the same initiator concentration), but wanted to control the molecular weight to 15,000. What concentration of n-butyl mercaptan (1-butanethiol) would you add?

(15 pts)