

MATRL 100A: Structure and Properties I, Assignment 6

This assignment is due on Monday, November 27.

Chapter 14

1. Draw structures for the following polymers (using the standard linear notation used in the book). Calculate the repeat unit molecular weight.
 - (a) Polypropylene
 - (b) PVC
 - (c) Polyurethane
 - (d) Polychloroprene (Neoprene)
 - (e) PETE
2. Calculate the weight average molecular weight, number average molecular weight, and degree of polymerization for poly(methyl methacrylate) with the following molecular weight distribution.

Molecular Weight Range (g/mol)	w_i	x_i
8,000-20,000	0.02	0.05
20,000-32,000	0.08	0.15
32,000-44,000	0.17	0.21
44,000-56,000	0.29	0.28
56,000-68,000	0.23	0.18
68,000-80,000	0.16	0.10
80,000-92,000	0.05	0.03

3. Using the equations for total chain length (L) and average chain end-to-end distance (r) below, determine the following for a linear polyethylene molecule.
 - (a) The number average molecular weight for $L = 2000$ nm.
 - (b) The number average molecular weight for $r = 30$ nm.

$$L = Nd \sin \frac{\theta}{2}, r = d\sqrt{N}$$

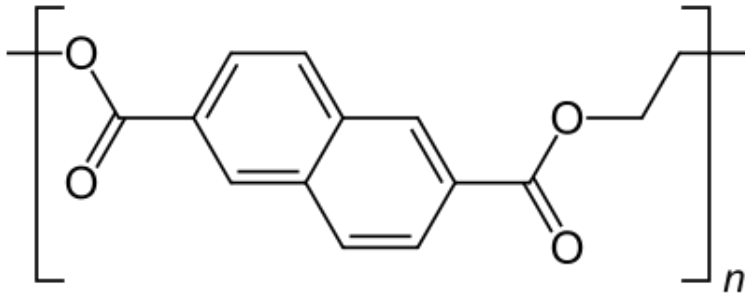
Where d is bond length between chain atoms, θ is the bond angle, and N is total number of bonds along the main chain of the polymer.

4. An alternating copolymer is known to have a number average molecular weight of 250,000 g/mol and a degree of polymerization of 3420. If one of the repeat units is styrene, which of ethylene, propylene, tetrafluoroethylene, and vinyl chloride is the other repeat unit, and why?

5. The density and associated percent crystallinity for two polypropylene materials are as follows:

ρ (g/cm^3)	crystallinity (%)
0.904	62.8
0.895	54.4

- (a) Compute the density of totally crystalline and totally amorphous polypropylene.
 (b) Determine the density of a specimen having 74.6 % crystallinity.
6. Using linear schematics, sketch portions of linear polystyrene chains that are:
 (a) syndiotactic
 (b) atactic
 (c) isotactic
7. Below are diagrams of the repeating structures for two alternating copolymers produced through condensation reactions. Draw the two initial components (mers) of these polymers.
 (a) Polyethylene naphthalate (H_2O is removed during condensation).



- (b) Polycarbonate (HCl is removed during condensation).

