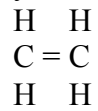


_____ (Print)
LAST NAME, FIRST NAME

(1) Polymer Structures

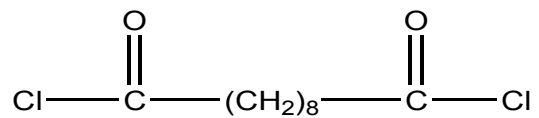
(a) (10 points) Ethylene, C_2H_4 , can be written.



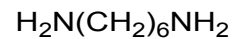
Write the corresponding schematic structure for polyethylene.

(b) (20 points) If a polyethylene molecule consists of 1,000 mers, calculate the longest stretched-out length of this molecule. C-C-C angle is 109° and C-C length is 0.154 nm.

(c) (20 points) Show a reaction product of two chemicals shown below.



Sebacoyl Chloride



Hexamethylenediamine

(2) (30) Average molecular weight

You are given three buckets of polystyrene, each of which is monodisperse (all molecules are of the same length). Bucket A has a molecular weight of 2,000 g/mol, bucket B has a molecular weight of 20,000 g/mol and bucket C has a molecular weight of 200,000 g/mol. A mixture is made consisting of 200 grams of each bucket.

$$M_n = \sum x_i M_i; \quad M_w = \sum w_i M_i$$

(a) What is the number-average molecular weight of the mixture?

(b) What is the weight-average molecular weight of the mixture?

(3) (20) Glass Transition Temperature

Sketch schematically,

(a) Specific volume vs. temperature diagram for a glass forming system, marking T_m and T_g clearly.

(b) Modulus (stiffness) vs. temperature for an amorphous (thermoplastic) polymer.