KJM-5500 - Exercises 2

1) Define the end-to-end distance and the radius of gyration for a random coil.
2) What is the relationship between R_G and r?
3) What is the molecular weight dependence of the radius of gyration for spherical particles and rod-like molecules, respectively?
4) In what way do r change when the solvent becomes thermodynamically poorer?
5) Write the expression for the average end-to-end distance in the model for a chain without restrictions. What is the meaning of this model?
6) If the chain has free rotation, but the bond angle has a fixed value, how do r change?
7) If the chain also has hindered rotation, a new factor enters the equation for r. What is the new factor?
8) What do the expression "long range effects" mean?
9) What is a "θ-solvent" and an "ideal conformation"?
10) Flory and Krigbaum have given a theoretical relation between the expansion coefficient, α, and the molecular weight. What happens when $T = \theta$? What happens to r when the molecular weight increases?
11) What is a good solvent?
12) Explain the excluded volume effect.

13) What is an ideal solution?

14) Describe the classical model of Flory-Huggins.

15) Show that $\Delta\overline{G}_1 = RT\left[\ln(1-\phi_2) + (1-\frac{1}{x})\phi_2 + \varepsilon_1\phi_2^2 \right]$ when we know that the Gibbs molar energy of mixing is given by $\Delta G_m = RT(n_1 \cdot \ln\phi_1 + n_2 \ln\phi_2 + \varepsilon_1 n_1\phi_2)$

16) What is the difference between a critical temperature (e.g. UCST) and the θ-temperature?

17) The following experimental data for the osmotic pressure is given:

C (kg/m^3)	2,56	3,80	5,38	7,80
Π (mm toluene)	3,25	5,45	8,93	15,8

Calculate M_n and A_2 (the second virial coefficient) for polystyrene in toluene at 25 ^oC. What do the virial coefficients express? Π = osmotic pressure; C = concentration of the polymer in toluene; R = the gas constant; ρ = 861.8 kg/m^3 (density of toluene at 25 ^oC); g = 9.81 m/s^2.

18) What is the concentration dependence (at low concentrations) of the osmotic pressure at θ-conditions?