Part 1
Do Problem 7.1, 7.2, and 7.3.
Do Problem 8.2 and 8.3.
Do Problem 9.1, 9.2, and 9.4.
Do Problem 11.4.
Do Problem 13.1 and 13.2.
Do Problem 14.2.

Part 2

1. Two monomers, X and Y, were copolymerized with styrene (ST), methyl acrylates (MA), and vinyl acetate (VAc). With the following monomer reactivity ratios found, answer the following questions.

A	B	r_A	r_B
X	ST	0.41	1.06
X	MA	0.76	0.09
X	VAc	3.4	0.07
Y	ST	0.02	2.3
Y	MA	0.14	4.4
Y	VAc	1.4	0.46

(a) Are the copolymerizations radical, cationic, or anionic? Explain.
(b) Which monomer pair could lead to azeotropic copolymerization? Explain.
(c) Is ST monomer more reactive or less reactive than monomer X toward the X propagating center? By what factor?
(d) List ST, MA, and VAc propagating center in the order of increasing reactivity toward monomer X.
(e) When copolymerized with monomer X, which of ST, MA, or VAc will be incorporated in the copolymer chain with the smallest run number? [Run number is the number of times per 100 repeat units a copolymer chain switches from one type of comonomer unit to the other.]
(f) Will monomer X or Y have the higher k_p in homopolymerization? Explain.

2. Answer the following questions.
(a) [3 x 3 pts]   In preparing block copolymers by living copolymerization, the order of monomer addition is critical. Describe the order in anionic, ATRP, and RAFT copolymerization.
(b) [10 pts]   There are four possible methods for the preparation of polybutadiene-*b*-polystyrene-*b*-polybutadiene (ABA triblock) copolymer <u>via anionic living polymerization</u>. What are they? No need to draw structure, just sketch and describe the methods. Beware of the copolymer sequence.
(c) You want to prepare a poly(styrene-*g*-methyl methacrylate) with tapered distribution of the graft. Describe your synthetic steps with the catalyst or initiator you may use from the box on the right.

(d) You want to prepare an alternating multi-block copolymer containing polystyrene and PET. Describe your synthetic steps with the catalyst or initiator you may use from the box on the right.
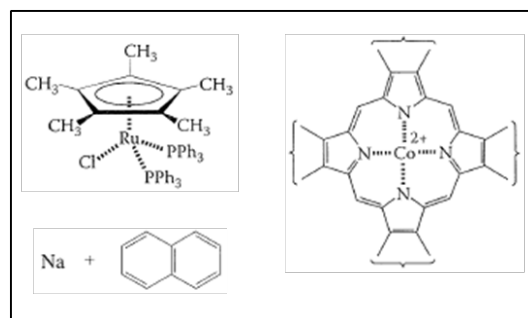
3. Answer the following questions.
   (a) While membrane osmometry gives the number-average molar mass, light scattering method gives the weight-average molar mass. Explain.
   (b) Dilute solution viscometry (DSV) gives only a 'relative' molar mass, not an absolute molar mass. Why is it regarded as 'relative?'
   (c) Gel permeation chromatography (GPC) gives chromatogram as a function of elution volume, and the chromatogram is converted to one as a function of molar mass using 'universal calibration.' What is the observation that enables the calibration?
   (d) DSV and GPC utilize an equation in common. Write down the equation. What is the name of the equation?