CHEMISTRY 471A
Advanced Topics in Chemistry
Macromolecular Chemistry

Spring 2010 Dr. Roy F. Gratz Jepson 338, 654-1412
Goolrick 205 E-mail: rgratz@umw.edu
3:00-3:50 MF Office hours: 9:00-9:50 MWF
9:30-10:30 T
1:30 - 2:30 R

POSSIBLE TEXTS: *Polymers: Chemistry and Physics of Modern Materials*, J. M. G. Cowie and V. Arrighi, CRC Press, Boca Raton, FL, 2008; *Introduction to Polymer Chemistry*, C. E. Carraher, Jr., CRC Press, Boca Raton, FL, 2007.

1. Introduction
   A. History and Background
   B. Polymer Nomenclature
   C. Molecular Weight Distributions
   D. Polymer Shapes
   E. The Glass Transition Temperature T_g and Melting Temperature T_m
   F. Classes of Polymers
      a. Fibers
      b. Plastics
      c. Thermosets
      d. Elastomers

2. Step-Growth Polymerization
   A. General Reactions
   B. Molecular Weight Control
   C. Kinetics
   D. Examples of Step-Growth Polymers

3. Free-Radical Addition Polymerization
   A. General Principles
   B. Polymerization
      a. Initiators
      b. Mechanism
      c. Kinetics
      d. Chain transfer
   C. Polymerization Processes

4. Ionic Polymerization
   A. General Principles
   B. Cationic Polymerization
      a. Mechanism
      b. Kinetics
   C. Anionic Polymerization
      a. Mechanism
      b. Living polymers

5. Copolymers and Other Architectures
   A. General Principles
   B. Free-Radical Copolymerization
   C. Alternating Copolymers
   D. Block Copolymers
   E. Graft Copolymers
   F. Dendrimers

6. Polymer Stereochemistry
   A. Tacticity
   B. Stereospecific Polymerizations
      a. Cationic
      b. Anionic

7. Coordination and Other Polymerizations
   A. Ziegler-Natta Catalysts
      a. Mechanisms
      b. Stereoregulation
   B. Other Polymerizations
      a. Ring-opening metathesis polymerization (ROMP)
      b. Group transfer polymerization (GTP)
      c. Metallocene Catalysts

Three 50-minute exams will be given on the following dates:
Friday, February 12
Friday, March 19
Monday, April 26, 3:30 - 4:20 p.m. (Finals week)
The first two exams will begin promptly at 3:00 p.m. and end promptly at 3:50 p.m.

Each of the three exams will count 25% of your grade (the final exam will be a third hour-exam and will not be cumulative.)

The remaining 25% of your grade will be based on a 20-25 minute presentation to be given on Friday, April 9; Monday, April 12; or Friday, April 18. Each of you will select a major commercial polymer and give a report on its history, production figures, synthetic methods, properties, uses, and current research. Possible polymers include polyethylene, polypropylene, polystyrene, poly(vinyl chloride), nylon, poly(ethylene terephthalate), or any other polymer of your choice, as long as it's a significant commercial polymer.

Mid-term grades are due on February 25 and will be based on your performance on the one exam completed up to that time. A grade of **U** will be given for **C-**, **D**, or **F** work.

The UMW Honor Code applies to all exams, and you should write the honor pledge on the top of each exam. The pledge is as follows:

I hereby declare upon my word of honor that I have neither given nor received unauthorized help on this work. (Signature)