CHEM ENG/CHEM C178 Polymer Science and Technology
Spring 2019

Lectures	Tuesdays and Thursdays, 8 am
Instructor	Nitash P. Balsara nbalsara@berkeley.edu Office Hours: Mondays 8-9 am and 11-12 am.
Textbook	*Polymer Chemistry*, 2^{nd} Edition, Paul C. Hiemenz and Timothy P. Lodge ISBN-13: 978-1574447798 The class will follow the book and homework assignments will include questions from the text.
Website	bcourses.berkeley.edu
Homework	Due at the start of class on specified dates. No late homework accepted. One homework grade dropped.
Grading	Homework 20% Midterm 30% Final 50%

All exams open textbook, your own notes, and your own homeworks (corrected). Nothing else (level playing field).

Please silence your cellphones. I will turn it off and place it in another room at the beginning of each class.

I prefer not to get emails. Please use office hour, or 8-8:10 am before class to set up a meeting time.

Communication must be respectful. All opinions and questions are welcome.

DATE	LECTURE TOPIC	READING
Week 1	Introduction Step-growth polymerization	Chapter 2
Week 2	Chain-growth polymerization	Chapter 3
Week 3	Controlled polymerization	Chapter 4
Week 4	Copolymerization stereoregulatity	Chapter 5
Week 5	Polymer confirmations	Chapter 6
Week 6	Thermodynamics	Chapter 7
TUE OCT 13 (no class)	MIDTERM	
Week 7	Scattering	Chapter 8
Week 8	Dynamics of dilute solutions	Chapter 9
Week 9	Networks	Chapter 10
Week 10	Viscoelasticity	Chapter 11
Week 11	Glass Transition	Chapter 12
Week 12	Crystalline polymers	Chapter 13
Weeks 13 and 14	Emerging applications: 3D printing, polymer solar cells, plastic electronics, solid lithium batteries	
5/14/19	FINAL EXAM	

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Questions that you will be able to answer

Ch1:

(a) When did polymers first arrive on earth?
(1) 3.5 billion years ago
(2) 1000 years ago
(3) 150 years ago
(5) 50 years ago

Why is nylon, used to make clothing and other things, similar to proteins that are responsible for most of the important functions in your body?
Both have amide linkages.

Ch 2: Why are polymers cheap?
(1) Reactants are abundant and available freely everywhere on the planet.
(2) The polymerization reactions are energetically uphill, but energy is cheap.
(3) Reactants are cheap but the supply is limited.
(4) Reactions are energetically downhill and do not require much energy.

Ch 3:
(a) What is the key to making smooth polymeric parts as done in Terminator 2 (grown from a puddle)?
(1) Slowing the rate of polymerization
(2) Increasing the rate of solvent evaporation
(3) Inhibiting polymerization
(4) Lowering the speed for producing the part

Ch 4:

Ch 5: Is it obvious that stereoregular polymers can be made synthetically?

Ch 6: It is pointless to draw out the molecular structure of a synthetic polymer. How can we understand molecule that you cannot even draw?

Ch 7: Why is it impossible to recycle plastics as they are produced and used today?

Ch 8: Scattering:

Ch 9: Dynamics of dilute solutions:

Questions we will answer:

1. What are polymers used for today?
2. How are polymeric parts made in today’s factories?
3. Can you make polymeric parts as done in Terminator 2 (grown from a puddle)?
4. Why is it pointless to draw out the molecular structure of a synthetic polymer?
5. Why is a gasket like an ideal gas?
6. Are polymers used to make silicon-based electronics?
7. Why are there separate recycling bins for different polymers?
8. Why gives McDonald’s milk-shake its creamy texture?
9. What controls the amount of water a diaper can hold?
10. Can you use experiments to predict how a polymer part will deform after 50 years?
11. What might polymers be used for in the future?

You will learn:

1. The chemical reactions used to produce polymers and the relationship between reaction conditions and the final product.
2. What polymer molecules look like and how one describes them.
3. Models for the thermodynamics of polymer mixtures.
4. Behavior of polymer solutions.
5. How to use solutions to characterize polymers.
6. How polymer networks behave.
6. How polymers respond to stress.
7. About the glass transition or polymer vitrification
8. About polymer crystallization.
9. About the emerging areas of polymer science and emerging challenges.