Materials 100A Fall 2018 Final Exam

The final exam is not cumulative. Only the second half of the class will be covered, starting with ceramics (Chapter 12). However, you may likely need to use what you have learned throughout the entire course to answer questions on the final. In general, everything covered in class and on the problem sets (starting with ceramics) is fair game for the exam. Below is a brief outline to aid your studying:

Chapter 12: Ceramics

1. The radius ratios of cations to anions and the notion of coordination number (number of anions surrounding a cation).
2. Structures of *AB* compounds (NaCl and CsCl, and how these are related respectively to *fcc* and *sc* lattices) and perovskite ABX_3
3. Schottky and Frenkel defects
4. Calculating distances and densities of compounds

Chapter 14: Polymers

5. Basic hydrocarbon chemistry and how monomers come together to form polymers
6. Types of bonds between monomers: Multiple bonds opening up and the condensation of water. The ability to go from polymer structure to monomers and *vice-versa*.
7. Working with molecular weights and degree of polymerization, crystallinity, *etc.* of polymers
8. Structure of polymers (*e.g.* linear *vs.* branched, *vs.* cross-linked, *vs.* networked and the different types of isomerism.
9. Polymer tacticity

Chapter 19: Thermal Properties of Materials

1. Heat capacity and the difference between specific heat and heat capacity
2. Thermal expansion and its origins
3. Thermal conductivity: Metals *versus* insulators.
4. Thermal behavior of different types of materials (polymers, metals, semiconductors, *etc.*)
5. The use of dimensional analysis to figure out units.

Chapter 18: Electrical Properties of Materials

1. Concepts of resistivity, conductivity, charge carriers (electrons and holes), and the Ohm law.
2. Electronic structure of extended solids
    a. Concepts of bands: valence band, conduction band, band gap, Fermi energy

    b. Metals *vs.* semiconductors and the concept that in semiconductors, all electrons are accounted for, in bonds
    c. electron mobility
3. Influence of temperature on resistivity
4. Doping semiconductors: *p*–*n* junctions and diodes
5. Electronic properties of intrinsic and doped semiconductors