ChE 231 - Spring 2009 - Open Book Question List

Chapter 3

1 Be able to calculate the coordination number, lattice constant, and atomic packing factor for FCC, BCC and HCP.
2 Be able to calculate the packing factor, density, for the cubic ionic crystal structures given in the text (NaCl structure, CsCl structure, zinc blende structure, pervoskite structure).
3 Be able to calculate the density of a material based on the crystal structure, and atomic weight for crystalline metallic and ceramic structures.
4 Be able to determine the atomic positions, directions and Miller indices in cubic unit cells.
5 Be able to calculate planar, and linear densities in cubic unit cells.

Example Problems 1, 2, 3, 5, 6, 12, 13
End-of-Chapter Problems 1, 3, 7, 13, 14, 27, 28, 36, 37

Chapter 5

6 Be able to convert atomic percent to weight percent and vice-versa

Example Problems 4, 5
End-of-Chapter Problems 7, 9 (be able to do these calculations for materials with more than two components)

Chapter 6

7 Be able to apply the equation for Fick's first law, relating diffusion flux, diffusion coefficient and concentration gradient
8 Be able to apply the solution to Fick's second law for a semi-infinite solid fixed a fixed concentration at the surface (The solution given by Equation 5.5)
9 Be able to apply the concept of activation energy and the effect of temperature on diffusion

Example Problems 1, 2, 3, 4, 5, Design Example 1
End-of-Chapter Problems 4, 6, 7, 8, 11, 12, 16

Chapter 7

10 Be able to calculate engineering stress and strain, both tensile and shear.
11 Be able to apply the definitions of elastic modulus and shear modulus.
12 Know the definition of Poisson's ratio and how it is used to relate the elastic and shear moduli.
13 Be able to read the yield strength and tensile strength from a stress-strain diagram.

Example Problems 1, 2, 3
End-of-Chapter Problems 2, 4, 8, 12, 15

Chapter 8

13 Be able to calculate the resolved shear stress, given an applied force and a specified slip system
14 Be able to calculate the amount of cold work in a material
15 Be able to develop a cold work / heat treatment process to meet a specified set of properties

Example Problems 1, 2, Design Example 1
End-of-Chapter Problems 7, 14, D.3, D.4

Chapter 9

16 Be able to calculate the maximum stress in a crack

Example Problems 1
End-of-Chapter Problems 1, 2

Chapter 10

17 Be able to read a pure component phase diagram
18 Be able to use a binary isomorphous phase diagram
19 Be able to determine the phases present, the compositions and amounts of each phase present at a given temperature and overall composition (application of the lever rule)
20 Be able to calculate the amount of proeutectic and eutectic material for a given phase
21 Be able to write a eutectoid, peritectic and monotectic reaction
22 Be able to identify the phases present on the Fe-C phase diagram and their structure
23 Be able to apply the lever rule on the Fe-C phase diagram
24 Be able to calculate the amount of proeutectoid versus eutectoid material for both hypoeutectoid and hypereutectoid steels
25 Be able to identify the invariant reactions on the Fe-C phase diagrams

Example Problems 1, 2, 4
End-of-Chapter Problems 5, 6, 7, 17, 18, 25, 28, 29, 32

Chapter 11

26 Be able to describe how an isothermal transformation diagram is developed, and identify the phases present given a path or heat treatment
27 Be able to describe how an continuous cooling transformation (CCT) diagram is developed, and identify the phases present given a path or heat treatment

Example Problems 2
End-of-Chapter Problems 8, 11, 14, 20