Material for Week 6

Physics 4488/6562: Statistical Mechanics

http://www.physics.cornell.edu/sethna/teaching/562/

Exercises due Mon. Mar 22

Last correction at January 7, 2021, 1:26 pm

All exercises are from the second edition of the text: http://pages.physics.cornell.edu/∼sethna/StatMech/EntropyOrderParametersComplexity20.pdf

Monday

In-class question: 6.13 *Pollen and hard squares*

Wednesday

Read: Chapter 6, Sec. (6.6) (Chemical equilibrium) and (6.7) (Free energy density)

Pre-class question: 6.15 *Gas vs. rubber band*

In-class question: 6.6 *Lagrange*

In-class question: 6.5 *Laplace*

In-class question: 6.7 *Legendre*

Friday

Read: Chapter 7, Sec. 7.1 (Mixed states and density matrices), Sec. 7.2 (Quantum harmonic oscillator), and 7.3 (Bose and Fermi statistics).

Pre-class question: 7.18 *Drawing wavefunctions*

In-class question: 7.19 *Many-fermion wavefunction nodes*

Monday

Read: Chapter 7, Sec. 7.4 (Non-interacting bosons and fermions) and 7.5 (Maxwell-Boltzmann 'quantum' statistics)

Pre-class question: 7.5 *Photon density matrices*

Exercises for everyone (4488 and 6562)

6.11 *Barrier crossing.*

6.25 *Epidemics and zombies.* Epidemiology studies the spread of disease through a population. The foundation of the field is the SIR model, tracking the susceptible, infected, and recovered people in the population. Our group had fun analyzing the SZR model, which illustrates stochastic effects in chemical reactions and gene mutation propagation.

7.10 *Crystal defects.*

Exercises for Graduate Course (6562 only)

6.26 *Nucleosynthesis as a chemical reaction.*

6.24 *Word frequencies: Zipf's law.*