

Material for Week 5

Physics 4488/6562: Statistical Mechanics

<https://sethna.lassp.cornell.edu/Teaching/562/>

Exercises due Wed. Feb 28

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The exercises with numbers N1.xxx are to be found in <https://sethna.lassp.cornell.edu/StatMech/SethnaExercises.pdf>

Enjoy your break next Monday.

Monday

In-class question: [5.10](#) *Entropy increases: diffusion*

In-class question: [5.15](#) *Shannon entropy*

Wednesday

Read: Chapter 6, Sec. 6.1 (Canonical Ensemble), 6.2 (Uncoupled Systems), and 6.3 (Grand canonical ensemble)

Pre-class question: [5.14](#) *Information entropy*

In-class question: [6.18](#) *Langevin dynamics*

In-class question: [5.15](#) *Shannon entropy*

Friday

Read: Chapter 6, Sec. 6.4 (What is thermodynamics?) and 6.5 (Mechanics: friction and fluctuations)

Pre-class question: [6.16](#) *Rubber band free energy*

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*

Exercises for everyone

[6.8](#) *Euler*. Do part (a) only.

Select zero – one (4488) or one – two (6562)

[N1.20](#) *Zeros in a byte*. (Computer Science) Test your wisdom about information entropy.

[N1.11](#) *Entropy of MastermindTM*. Inspired by Wordle, entropic strategy in a guessing game.

[6.3](#) *Negative temperature*. Temperature can be negative in the microcanonical ensemble. See how it compares to the canonical ensemble.

[5.21](#) *Data compression*. Using compression algorithms to estimate entropy

[5.24](#) *Nucleosynthesis and the arrow of time*. (Astrophysics) How we understand why the stars can shine and the arrow of time.

[5.26](#) *Phase conjugate mirror*. When the entropy increases depends on what you keep track of. It's ignorance that matters.

[5.17](#) *Deriving entropy*. (Mathematics) How Shannon's entropy uniquely satisfies sensible

axioms.