Physics 375: Thermal & Statistical Physics; TΘ 12:40PM-4:00PM; Zoom

Tuesday	Thursday
Feb 2nd **1** Read through Schroeder p. 28 (§1.1-1.4) What is Statistical Physics?; Thermal equilibrium; Microscopic model of ideal gas; equipartition theorem; heat and work Problems in class: 1.4, 1.14, 1.18 HW #1: 1.7(a), 1.8, 1.16, 1.17, 1.20	4th **2** Read through Schroeder p. 48 (§1.5-1.7) Compressive work; Heat capacities; Rates of processes Problems in class: 1.37, 1.45 HW #2: 1.22 (a,b,c,e - give radius), 1.31, 1.34, 1.36, 1.43
9th **3** Read through p. 59 (§2.1-2.3) Two-State Systems; Einstein model of a solid; Interacting systems Problems in class: Class choice HW #3: 2.4, 2.5, 2.6, 2.8	11th **4** Read through p. 73(§2.4-2.5) Large Systems; Ideal Gas Problems in class: One of the below. Class votes. HW #4: 2.11, 2.16, 2.17, 2.18, 2.19, 2.21
16th **5** Read through p. 92 (§2.6, 3.1) ENTROPY!; Temperature Problems in class: class choice! HW #5: 2.29, 2.31, 2.33, 2.35, 2.37	18th **6** Read through p. 107 (§3.2, 3.3) Entropy and Heat; Paramagnetism Problems in class: class choice! HW #6: 2.38, 3.3, 3.6, 3.13, 3.14 Additional problem from class.

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23rd **7** Read through p. 121 (§3.4, 3.5, 3.6) Mechanical Equilibrium and Pressure; Diffusive Equilibrium and Chemical Potential Problems in class: class choice! HW #7: 3.24, 3.30, 3.32, 3.35, 3.36a	25th **8** Read through p. 220-237 (§6.1-6.2) The Boltzmann Factor, Average values Problems in class: class choice! HW #8: 6.3 (it's easier to define some dimensionless variable $t = kT/\epsilon$ and plot $Z(t)$), 6.4, 6.11, 6.12, 6.13, 6.22ab Extra Credit: the rest of 6.22 (we'll do the rest of the problem in class, so you can earn extra credit only by bringing this to class finished)
Mar 2nd **9** Read through p. 327-356 (§8.2) Ising models Problems in class: class choice! HW #9: 8.15, 8.17, 8.25, 8.26	4th **10** **Guest Lecture** **First test through §6.2, due at beginning of next Tuesday's class** Read additional assigned material (Ising.pdf) and §8.2 Continue §8.2, more about MC; MC Pi estimation, Monte Carlo Simulation Coding; March Madness code. Problems in class: HW #10: 8.16, 8.18, 8.23
9th **11** Read through p. 122-148 (§4.1-4.4) **More than most days, you must have done the reading ahead of class** Heat Engines and Refrigerators (§4.1-4.2) For discussion, but not as important: §4.3-4.4 Problems in class: class choice! HW #11: 4.7, 4.8, 4.12, 4.14	11th **12**

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16th **13** Read through p. (§1.7) Diffusion, rates Problems in class: class choice! HW #12: 1.56, 1.68 (hint: you can make life easier by reading page 47 and assuming that the perfume has spread to half of the room), report on one interesting topic from Sethna. March Madness Monte Carlo problems 1-3 (see the github site) Extra credit: finish 1.57,	18th **14** Read through p. 149-165 (§5.1-5.2) Free energy available as work; Free Energy as a force towards equilibrium Problems in class: 5.7, class choice! HW #13: 5.4, 5.8, 5.9, 1.40, March Madness Monte Carlo problems 4-5.
23rd **15** Read through p. 166-185 (§5.3) Phase Transformations of Pure Substances Problems in class: class choice! HW #14: 5.26, 5.32, 5.48, 5.52 Extra credit: 5.51	25th **16** **Read lab handout** **Lab #1: Diffusion& modern microscopy** Problems in class: start analysis! HW #15: finish analysis
30th **17** Read through p. 186-199 (§5.4) Phase Transitions of Mixtures Problems in class: class choice! HW #16: 5.35	Apr 1st **18** **You may begin Lab #2: Entropy of Unknotting at any point after this lecture.** Read through p. 200-207, 238-246 (§5.5, §6.3-6.4) Dilute Solutions; Equipartition; Maxwell Speed Distribution Problems in class: class choice! HW #17: 5.75, 5.76, 5.82, 6.31, 6.38 Extra Credit: 5.81, 6.39

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6th **19** Read through p. 247-256 (§6.5-6.7) Partition Functions, Free Energy and Composite Systems Also catch up Problems in class: class choice! HW #18: work on your papers Extra credit: 6.43, 6.48, 6.53(!)	8th **20** **Read lab handout** **Lab #3: Simulation of free energy 1** Problems in class: lab! HW #19: Finish lab!
13th **21** **Project Topics Due** Read provided additional material Student choice: The new fluctuation theorems *or* project workday. Problems in class: class choice! HW #20: Extra credit: Jarzynski problem from Tuckerman.	15th **22** **Project Paragraph Due** **Read lab handout** We'll be working through the "Stretching Deca-alanine" tutorial from the Computational Biophysics folks at UIUC. We'll work through the in-class portions in class, but you'll need to read the three emailed PDFs ahead of time. **Lab #4: Simulation of free energy 2** Problems in class: lab! HW #21: Finish lab!
20th **23** **Second test** Read through p. 257-270 (§7.1-7.2) Class Handout: VariousQMDistributions.PDF The Gibbs Factor; Bosons and Fermions Problems in class: class choice! HW #22: 7.8, 7.10, 7.11ace, 7.13 Extra Credit: 7.9, 7.13 the rest, 7.18	22nd **24** Read through p. 271-287 (§7.3) Degenerate Fermi Gases, Density of States Problems in class: class choice! HW #23: 7.23fg, 7.41 (i.e. "how lasers work") Extra Credit: 7.22, 7.23abcde, 7.42 (if you do *not* do these for extra credit, ask Michael for the solutions, as they're required for the other problems.)

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27th **25** Read through p. 271-287 (§7.3) Density of States catch up Problems in class: class choice! HW #24: work on your papers Extra credit: 7.33, 7.34, 7.35	29th **26** Read through p. 307-326 (§7.5-7.6) Debye Theory of Solids; Bose-Einstein Condensation Problems in class: class choice! HW #25: work on your papers Extra credit: 7.58, 7.60, 7.64
May 4th **27** **PROJECT PRESENTATIONS!**	6th **28** **PROJECT PRESENTATIONS!**
11th **29** Read through p. Problems in class: class choice! HW #26:	13th **30** Read through p. Problems in class: class choice! HW #27:
18th **31**	20th **32**
25th **33**	27th **34**