Tentative schedule

Physics 215, 101
University of British Columbia, Okanagan

This is I would like to cover, roughly by date, and sections of the required and optional texts. You are expected to at least read the required Schroeder text chapters for this course.

Lecture #	Date	Topics	Suggested Reading
1	Jan. 9	Syllabus, phases, state variables, density, number density, pressure	K16.1, 16.2
2	Jan. 11	Pressure: atmospheric, hydrostatic, buoyancy, Temperature and thermal equilibrium,	K15.1, 15.2, 15.4, K16.2, S 1.1
3 (videos)	Jan. 13	(Please complete online video quizzes in lieu of in-person lecture) Mass conversions, phase changes (phase diagrams of $H_2$0 and CO_2), ideal gases (potential energy, assumptions)	K16.3-16.5, S1.1,1.2 (p. 6-9)
4	Jan. 16	The exponential atmosphere (application of ideal gas)	S1.2
5	Jan. 18	pV diagrams-Ideal gas processes:isothermal (why hyperbola), isochoric, isobaric, adiabatic, proportional reasoning, energy conservation: work done on a gas and relation to pV diagram	K16.6, S1.2 (p. 6-9) K17.1-17.4,
6	Jan. 20	Energy conservation: work done on a gas and relation to pV diagram, expansion/contraction video, heat, the first law of thermodynamics, heat capacities, specific heat	K17.1-17.5, S1.4-1.6
7	Jan. 23	Calorimetry, latent heat, specific heat of gases (C_p, C_v), relation & derivation, partial derviatives,	K17.5, 17.6, S1.6 (p.28-29), K17.7
8	Jan. 25	$PV^\gamma =$ const. proof (adiabatic), energy transfer mechanisms (evaporation (dippy bird), conduction & thermal conductivity, convection, radiation)	K17.8, K18.2, 18.3, S1.4,S1.2(p.10-12), S1.7
9	Jan. 27	Radiation, Micro/macro connection, molecular speeds, pressure in a gas, $p \propto (v^2)_{average}$, average translational energy, equipartition of energy, average velocity, rms speed	K18.1-18.4, S1.3, S1.6 (p.29-32)
10	Jan. 30	Specific heat (C_p, C_v) from partial deriv., C_v: solid, diatomic C_v is temperature dependent, thermal interactions and heat, Enthalpy and relation to heats of transformation, work done on atmosphere by a boiling gas	K18.5, 18.6, S1.6 (p.33-37)
11	Feb. 1	Irreversible processes & the 2nd law, degrees of freedom, order, disorder and entropy, irreversible processes and most probable	S1.6 (p.29-32),2.1
12	Feb. 3	Number of ways to make n choices from N possibles (poker), macrostates & multiplicity: e.g. 2-state paramagnets, Einstein solids (dot-line microstates)	S2.1, 2.2
13	Feb. 6	Two Einstein solids (interacting systems), fundamental assumption of statistical mechanics, irreversible processes, Dealing with large numbers: Stirling's approximation and its origin	S2.3, S2.4, Appendices B2, B3
14	Feb. 8	Gaussian integration, multiplicity of two Einstein solids (high T limit)	S2.4, Appendix B1
15	Feb. 10	First midterm (material to end of Feb. 3 lecture)	
16	Feb. 13	Two solids: energy distribution, width of peak, 1D waves on a string, de Broglie momentum, kinetic energy of particle in a box, ideal gas state counting	S2.4-2.6
17	Feb. 15	Entropy & relation to 2nd law (Maxwell's demon), entropy of an ideal gas (Sackur-Tetrode) Entropy of an ideal gas: expansion, entropy increase due to heat, free expansion	S2.5, S2.6
18	Feb. 17	Entropy of mixing, thermal equilibrium of two Einstein solids maximizes entropy, temperature/entropy relation, internal energy and heat capacity from multiplicity (Einstein solid), in reverse: measure C_v to find entropy change and infer $S(T)$, geometrically frustrated magnets: residual entropy,	S2.6, S3.1, 3.2

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No	Feb. 17-21	Family Day (University closed), midterm break (no classes this week)	
19	Feb. 27	Two-state paramagnet: entropy, internal energy, magnetization, hyperbolic functions	S3.3
20	Mar. 1	Two-state paramagnet: heat capacity and Curie law, thermodynamic identity	S3.3, S3.4
21 (video)	Mar. 3	(Please complete online video quiz) Pressure & chemical potential relation to entropy, chemical potential of an ideal gas, heat engines: $W_s = -W$ work done by and on a gas	S3.4-3.6, 4.1
22	Mar. 6	Heat engines: conservation of energy & efficiency, power plant efficiency & evapouration, Carnot cycle	K19.1-19.2, S4.1
23	Mar. 8	Refrigerators, coefficients of performance, power usage of heat pumps,	K19.2-19.6, S4.1, 4.2
24	Mar. 10	Stirling engine, internal combustion engine (Otto cycle)	S4.3, S4.4
25	Mar. 13	Internal combustion engine (Otto cycle), real refrigerators	S4.3, S4.4
26	Mar. 15	Real refrigerators: throttling, magnetic cooling, laser cooling	S4.4
27	Mar. 17	Second midterm (material to end of Mar. 10 lecture)	
28	Mar. 20	Laser cooling, systems & reservoirs, free energy: Helmholtz, Gibbs, electrolysis, fuel cells, Gibbs free energy: lead acid battery, thermodynamic identities & Maxwell relations,	S4.4, S5.1, S5.2
29	Mar. 22	Phase diagrams, examples of phases: superfluidity, magnetic order, superconductivity, nematic order, Gibbs free energy vs. pressure for diamond and graphite, Clausius-Clapeyron relation: evolution of free energy on a phase boundary and	S5.3
30	Mar. 24	Clausius-Clapeyron relation: application to melting of ice and application to the vapour pressure equation	5.3
VWD	Mar. 24	Last day to voluntarily withdraw from class with a W	
31	Mar. 27	Extensive vs. intensive quantities, chemical potential relation to Gibbs free energy and form for ideal gas	S5.3 S5.3
32	Mar. 29	Phase transformations, vapour pressure, van der Waals model, volume changes, Maxwell construction, phase diagram/pV diagram relation and definition of critical point	S5.3, S5.4
33	Mar. 31	Entropy of mixing and limiting behaviours, Gibbs free energy of unmixed and ideally mixed systems: role of entropy of mixing, ΔU_{mixing}, solubility gap	S5.4
34	Apr. 3	Immiscible and miscible phases, eutectics & eutectic points	S5.4
35	Apr. 5	Dilute solutions, molality, osmotic pressure	S5.5
No	Apr. 7	University closed (Good Friday, no lecture)	
No	Apr. 10	University closed (Easter Monday no lecture)	
36	Apr. 12	Equilibrium conditions for chemical reactions: law of mass action, dissociation of water, equilibrium conditions for chemical reactions: gases dissolving in water (Henry's law), partial pressure, ionization reactions*	S5.6
TBA	TBA	Boltzmann statistics* (Boltzmann factor, partition function) and application to the excitation levels of hydrogen atoms on the sun*	S6.1*