2.43 Advanced Thermodynamics

How to prepare for the final oral exam

The first 5 min will be on a topic of your choice (15 points). The ideal setup is the same as you have done for the various take-home assignments, except that you will perform it live and the choice of slides is free. You may choose your topic to be one of the 10 questions listed below, or you may choose any another one that we have covered in class (excluding of course those already covered in the homeworks).

Next I will ask you three questions (10 points each) chosen from the following set list. Again, I strongly suggest that you prepare in advance your selection of slides for each of these topics, so that you have them ready for use to provide a 5 min answer.

1) Osmotic pressure (explain the setup and modeling assumptions that lead to the van't Hoff relation, and discuss some of its implications and/or applications).
2) Liquid-vapor equilibria in ideal mixtures (explain the setup and modeling assumptions that lead to the Raoult law, and discuss some of its implications and/or applications).
3) Stratification (explain the setup and modeling assumptions that allow to compute how composition varies with position in a gravitational, centrifugal, or electrostatic field).
4) Separation (minimum work for complete or partial separation of a gas mixture).
5) Representation on an energy-entropy or enthalpy-entropy diagram of the exergy of a fuel, the irreversibility of an adiabatic flame, the effect of preheating the reactants or diluting them with the products of combustion.
6) Onsager reciprocity from the maximum entropy production principle, Ziegler orthogonality.
7) Outline the possible cross effects/couplings between different transport phenomena and explain when the Curie symmetry principle forbids couplings of different tensorial character.
8) Heat&diffusion interaction (explain the generalization of the definition of heat interaction to when there are also exchanges of particles, with and without electric charge).
9) Onsager reciprocity and thermoelectric effects (start from the 2x2 system of flux-force relations, explain how one gets to the equations in terms of familiar variables, outline the main applications).
10) Onsager reciprocity and thermodiffusion effects (start from the 2x2 system of flux-force relations, explain how one gets to the equations in terms of familiar variables, outline the main applications).

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