Thermo-Course Surprise Quiz (45 min)

[may be given after Chapter 5, ca 7th lecture]

1) A system contains Mg, Si, Al, and O. The system can exchange entropy and O with its environment, but is otherwise closed:

- If the system is in equilibrium with its environment, then which thermodynamic variables have the same values in both the system and its environment? Which variables may have different values?
- Derive a differential function that can be used to test stability in this system, what are the necessary conditions for the use of this function (i.e., what constraints are there on the nature of any interactions between the system and its environment)?
- How many phases may be stable in the system for arbitrary environmental conditions?
- If the environmental conditions vary in such a way as to cause a heterogeneous reaction within the system, what properties will the reaction conserve? How many phases will be involved in the reaction?

2) Can the isobaric heat capacity of a stable form of matter be < 0? Why? This question is most easily answered by considering the geometry of the extremal surface bounding physically accessible states as a function of specific entropy and enthalpy at constant pressure.

3) Which rheologies are non-dissipative?

4) Heat conduction and viscous deformation are important dissipative mechanisms during seismic wave propagation. Explain why and how they are frequency dependent.