Homework 1
Advanced Materials Termodynamics
Due August 28, 2021 midnight

1) Give an expression for $(\delta H/\delta V)_T$ in terms of α_P and κ_T. Explain a situation where this expression might be useful.
2) First and second order transitions have different properties. First order transitions display a discrete change in state functions like density, enthalpy, entropy, while second order transitions do not. Explain the molecular basis for the difference between a first order and second order transition using the Curie Temperature (https://en.wikipedia.org/wiki/Curie_temperature).
3) Explain how to build a differential scanning calorimeter and the difference between a DSC and a modulated DSC (MTDSC). Why would you need an MTDSC? What are the axis on the thermograph produced by a DSC? Explain their origin.
4) Yao K, Zhou C, Wng J, Li Q, Yuan, C, Xu J, Chen G, and Rao G *A new strategy to realize high energy storage properties and ultrafast discharge sped in Sr0.7Bi0.2TiO3-based relaxor ferroelectric ceramic* J. Alloys Cmpd. **883** 160855 (2021). developed new capacitors based on "ergodic relaxor ferroelectrics". Explain what an ergodic relaxor is and how it can enhance dielectric properties.
5) Explain how equation 1 relates to Table 1.1 in the notes/book.
6) On page 5 Yao says "No obvious current peaks can be detected, confirming the ergodicity". Explain this statement.