1) Give an expression for \((\delta H/\delta V)_T\) in terms of \(\alpha\) and \(\kappa T\). 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 speed in Sr0.7Bi0.2TiO3-based relaxor ferroelectric ceramic J. Alloys Compd. 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.