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Jimma University, College of Natural Sciences

Physics Department

Assignment I on the Course Statistical Physics II (Phys 3092)

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Part I: Conceptual Question

1. State the following briefly : a) Zeroth law of thermodynamics b) 1st law of thermodynamics c) 2nd law of thermodynamics d) 3rd law of thermodynamics
2. Describe intensive & extensive state variable with their examples.
3. Differentiate an open system, a closed system and an isolated system.
4. Maxwell relations express: (conservation laws, the conditions under which phase transitions occur, relations among thermodynamic variables, or the properties of ideal gases only)

   Part II: Problems
1. Derive for an enthalpy dH =TdS +VdP
2. Start from the first law of thermodynamics show dG=-SdT +VdP
3. Start from the first law of thermodynamics & show all four Maxwell relations.
4. Using the definitions of C_P and C_V and the first law of thermodynamics and the, derive the general relation:

$$c_P - c_V = \left[P + \left(\frac{\partial E}{\partial V} \right)_T \right] \left(\frac{\partial V}{\partial T} \right)_P$$

5. From the fundamental differential relation for dE and the differential relation for Helmholtz free energy dF = - SdT –PdV show that for a constant number of particles:

$$\left(\frac{\partial E}{\partial V} \right)_T + P = T \left(\frac{\partial P}{\partial T} \right)_V$$