3rd EASTERN UNIVERSITY, SRI LANKA

~~SECOND~~ EXAMINATION IN SCIENCE-2010/2011

FIRST SEMESTER

APRIL/MAY 2013

PH 302 THERMODYNAMICS

Time: 1 hour

Answer ALL Questions

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1. Distinguish an adiabatic process from an isothermal process in thermodynamics.

   (a) Derive an expression for the work done, in terms of the principle specific heat constant γ (where $\gamma = C_P/C_V$), when an ideal gas undergoes an adiabatic process from initial state with volume V_1 and pressure p_1 to final state with volume V_2 and pressure p_2.

   (b) Derive an expression for the work done in one mole of ideal gas which undergoes an isothermal process from initial state volume V_1 to final state volume V_2.

   (c) Sketch a characteristic $p - V$ diagram illustrating the working cycle of a Carnot engine which uses ideal gas as a working fluid. Defining necessary parameters, explain briefly how the results obtained in (a) and (b) can be used to describe complete function of the Carnot engine.

2. Define Helmholtz free energy F and Gibbs free energy G for a hydrostatic system and any quantities used in these definitions. Describe the importance of the energies F and G in thermodynamics.
   Derive the Maxwell relations associated with the energies F and G.
   Hence, using the derived Maxwell relations establish the following TdS equations

$$TdS = C_V dT + T\left(\frac{\partial P}{\partial T}\right)_V dV$$

and

$$TdS = C_P dT - T\left(\frac{\partial V}{\partial T}\right)_P dP.$$