EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2007/2008

FIRST SEMESTER (SPECIAL REPEAT)

(FEBRUARY 2010)

PH 302 THERMODYNAMICS

Time: 01 hour.

Answer ALL Questions

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1. Distinguish adiabatic and isothermal processes. An ideal gas may be defined as one whose equation of state is, $PV = nRT$. and whose internal energy is only a function of temperature. Show that for an ideal gas,

   (a) The quantity PV^{γ} is constant during an adiabatic process (assume that $\gamma = \frac{C_P}{C_V}$ is constant)

   (b) The work done in adiabatic expansion of the gas from (P_1, V_1) to (P_2, V_2) is, $\frac{1}{\gamma - 1}(P_1V_1 - P_2V_2)$.

   (c) The heat absorbed by one mole of gas in an isothermal expression from volume V_1 to V_2 is $RT \ln\left(\frac{V_2}{V_1}\right)$.

   Where other symbols have their usual meanings.

A diatomic gas ($\gamma = 1.4$) of volume $1.0m^3$ at a pressure of $1.01 \times 10^5 Nm^{-2}$ is compressed adiabatically until the volume is reduced to $0.4m^3$. Find the work done on the gas during the compression.

2. What do you mean by a "Carnot engine"? Define the term "Thermal efficiency" and write down the mathematical equation for thermal efficiency.

(a) A Carnot's engine working between 27^0C and 127^0C takes up $800J$ of heat from the reservoir in one cycle. What is the work done by the engine?

(b) Write down the relations for Helmholtz free energy (F), Enthalpy (H) and Gibb's function (G) then drive Mazwell's four thermodynamics relations.