EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2009/2010

FIRST SEMESTER (PROPER)

(June/July 2011)

PH 302 THERMODYNAMICS

Time: 01 hour.

Answer ALL Questions

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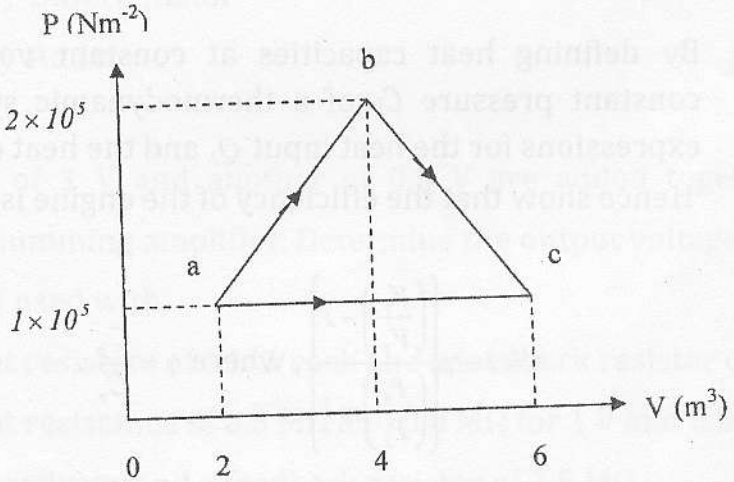
1. Give the mathematical statement of First Law of Thermodynamics for a finite process and the sign convention.

   Explain what is meant by isothermal and isochoric thermodynamic processes and write down the mathematical statements of the first law of thermodynamics for these process.

   A gas expands from a volume of $2\ m^3$ to a volume of $6\ m^3$ along the two paths abc and ac ac as shown in the figure.



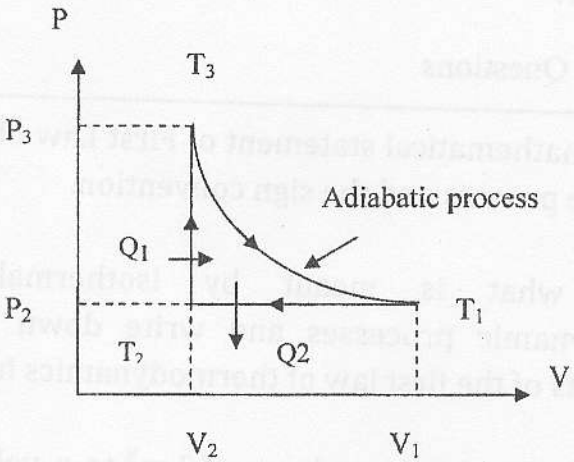
   If a heat of 8×10^5 J is added to the gas system along the path abc then find,

   i. the work done by the gas along the paths abc and ac;
   ii. the change in internal energy along the path abc.
   iii. the heat added to the system along path ac, explaining clearly the reasons for each step in your calculations.

2. By describing the function of a heat engine, derive an expression for efficiency η in terms of the heat input and the heat rejected from the engine.

An imaginary ideal gas engine operates in a cycle as shown in the figure below.

(a) What do you mean by an adiabatic process?



(b) By defining heat capacities at constant volume C_V and constant pressure C_P of a thermodynamic system, obtain expressions for the heat input Q_1 and the heat output Q_2.

(c) Hence show that the efficiency of the engine is,

$$\eta = 1 - \gamma \left\{ \frac{\left(\frac{V_1}{V_2}\right) - 1}{\left(\frac{P_3}{P_2}\right) - 1} \right\}, \text{ where } \gamma = \frac{C_p}{C_v}.$$