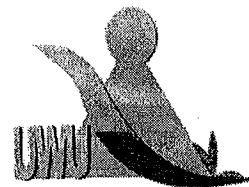


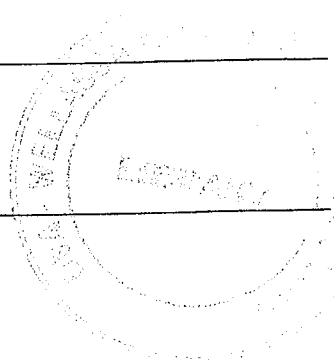
Uva Wellassa University, Sri Lanka
End Semester Examination – August/September 2011
SCT 254-1 Thermodynamics



Time: One (01) hour

Answer all four (04) questions
25 marks for each question

$$R = 8.31 \text{ J/mol} \cdot \text{K}^{-1}$$
$$1 \text{ atm} = 101,325 \text{ Pa}$$



- 01) I. State the first law of thermodynamics.
II. For an adiabatic expansion of a perfect gas with temperature T and volume V , show that
$$TV^{\gamma-1} = K$$
, where γ and K are constants.
III. A quantity of dry air at 27°C is compressed suddenly to $\frac{1}{3}$ of its original volume. Find the change in temperature assuming γ to be 1.4 for dry air.

- 02) I. State the importance of P-V diagrams.
II. When a system is taken from the state a to the state b in Figure Q2 along the path acb , 90 Joules of heat flows into the system, and 60 Joules of work is done by the system.
(a). How much heat flows into the system along the path adb , if the work done by the system is 15 Joules?
(b). When the system is returned from b to a along the curved path, the absolute value of the work done by the system is 35 Joules. Does the system absorb or liberate heat? How much heat?
(c). If $U_a = 0$, $U_b = 8$ Joules, find the heat absorbed in the processes ad and db . Here U_a and U_b are internal energies of the state a and state b respectively.

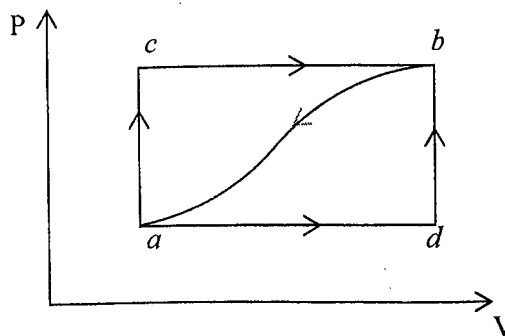


Figure Q2

- 03) I. What is meant by a reversible process?
II. State the second law of thermodynamics.
III. Describe Carnot's cycle and obtain an expression for the efficiency of a Carnot's engine.
IV. A Carnot's engine whose temperature of the source is 400 K takes 840 Joules of heat at this temperature and rejects 630 Joules of heat to the sink. Find the
a. Temperature of the sink
b. Efficiency of the engine
- 04) I. Explain the physical meaning of entropy.
II. Show that during a reversible adiabatic process the entropy of the system remains constant.
III. A mass m of a liquid at temperature T_1 is mixed with an equal mass of same liquid at temperature T_2 . The system is thermally insulated. Show that the entropy change of the universe is ;

$$2mC \ln \frac{(T_1 + T_2)}{2\sqrt{T_1 T_2}}$$

where C is the specific heat capacity of the liquid.