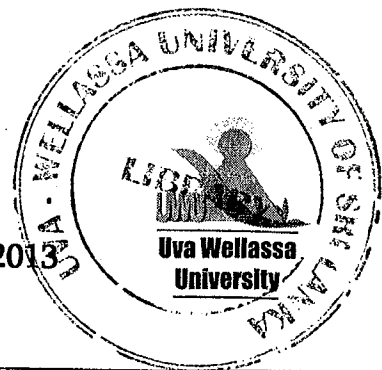


Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Science and Technology Degree Program
2st Semester Examination – September/ October 2013
SCT 254-1 Thermodynamics



Total no. of questions: (05) five

Answer four (4) questions including the question No 1

Use standard symbols without a definition. Use SI units.

Time allocation: One hour (1 hour)

1. a. Briefly explain the following terms

Thermodynamic system

Surrounding

Boundary

Diathermic and adiabatic boundary

Isolated, open and closed systems

(10 marks)

- b. What is a thermodynamic process? Show it in an indicator diagram.

(5 marks)

- c. In a separate indicator diagrams, show an isochoric and an isobaric processes.

(5 marks)

2. a. The Zeroth law of thermodynamics introduces an important concept about the state of matter. What is this concept? Explain it with an aid of a diagram.

(10 marks)

- b. Write the equation of state in more general form including pressure, volume and temperature.

(5 marks)

- c. For a hydrostatic system where $p = p(V, T)$, the expansivity, α , and the isothermal elasticity, E , are given by

$$\alpha = 1/V (\partial V/\partial T) \text{ at constant } P \text{ and } E = -V (\partial P/\partial V) \text{ at constant } T, \text{ respectively.}$$

Show that for an isobaric process, the rate of change of pressure, *i.e.*, $(\partial p/\partial t)$ at constant V , is equal to the product of the expansivity and the isothermal elasticity of the system.

(10 marks)

- d. Hence, show that the rate of change of pressure is large for the gas when the compressibility β of a gas is small.

(5 marks)

3. a. Explain what do you mean by "the internal energy" of a system.

(5 marks)

- b. In thermodynamics, we are usually interested in processes that can change the internal energy of a system. Describe the processes that can be employed to change the internal energy of a system.

(10 marks)

- c. State the first law of thermodynamics for a diffusively interacting system (use standard symbols) identifying all terms.

(5 marks)

- d. In a cyclic process, there are two exothermic and two endothermic stages. The heat transfer in each stage are, + 17.4 kJ, -52.2 kJ, -5.36 kJ and +31.5 kJ.

- i. Identify endothermic and exothermic stages in the process.

(5 marks)

- ii. Calculate the net work done in this cyclic process.

(5 marks)

4. a. Show that in an adiabatic expansion process of a gas, a cooling is produced. Name and explain the function of a household machine built based on this concept.

(10 marks)

- b. For an adiabatic expansion of one mole of an ideal gas, show that the following relationship holds

$$TV^{(\gamma-1)} = \text{constant}, \text{ All symbols have usual meaning.}$$

$$\text{Where } \gamma = C_p / C_v$$

(10 marks)

- c. Hence or otherwise show that the total work done, W , in an adiabatic expansion of an ideal gas is proportional to the fall in the temperature of the gas.

(10 marks)

5. a. Explain the scientific background which led to the development of 2nd law of thermodynamics.
- b. What are the two familiar forms of the 2nd law?
- c. What is a heat engine? Explain how it works with the help of a diagram.
- d. Describe why 100% efficient heat engine is practically not possible.
- e. What do you mean by entropy of a system?

(30 marks)