



UNIVERSITI KUALA LUMPUR
MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION
JULY 2010 SESSION

SUBJECT CODE : FRB 20102 / FMB 32202
SUBJECT TITLE : BASIC THERMODYNAMICS / THERMODYNAMICS
LEVEL : BACHELOR
TIME/DURATION : 4.00pm – 6.00pm
(2 HOURS)
DATE : 11 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. All questions carry equal marks. Answer ONLY FOUR (4) questions in English.
 2. Please write your answers on the answer booklet provided.
 3. Answer should be written in blue or black ink except for sketching, graphic and illustration.
 4. This question paper consists of FIVE (5) questions. Answer FOUR (4) questions only.
 5. *Answer all questions in English.*
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THERE ARE 3 PRINTED PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ONLY FOUR (4) questions

Please use the answer booklet provided.

Question 1

An insulated rigid tank is divided into two equal parts by a partition as shown in Figure Q1. Initially, one part contains 4 kg of an ideal gas at 800 kPa and 50°C, and the other part is evacuated. The partition is now removed, and the gas expands into the entire tank.

Determine:

- (a) The final temperature. (10 marks)
- (b) The final pressure in the tank. (15 marks)

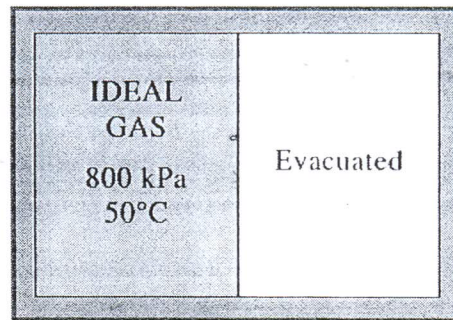


Figure Q1 An insulated rigid tank

Question 2

Steam enters an adiabatic turbine at 10 MPa and 500°C and leaves at 10 kPa with a quality of 90 percent. Neglecting the changes in kinetic and potential energies, determine:

- (a) Enthalpy (h) in kJ/kg and entropy (s) in kJ/kg K at turbine inlet and outlet. (8 marks)
- (b) Sketch the process on T-S diagram (8 marks)
- (c) The mass flow rate (in kg/s) required for a power output of 5 MW. (9 marks)

Question 3

An inventor claims to have developed a heat engine that receives 700 kJ of heat from a source at 500 K and produces 300 kJ of net work while rejecting the waste heat to a sink at 290 K.

- (a) Is this a reasonable claim? (10 marks)
- (b) Why? (15 marks)

Question 4

Refrigerant-134a is throttled from 900 kPa and 35°C to 200 kPa. Heat is lost from the refrigerant in the amount of 0.8 kJ/kg to the surroundings at 25°C. (See Figure Q4). Determine:

- (a) Enthalpy (h) in kJ/kg and entropy (s) in kJ/kg K at the inlet and outlet of the device. (10 marks)
- (b) The entropy generation during this process in kJ/kg K. (15 marks)

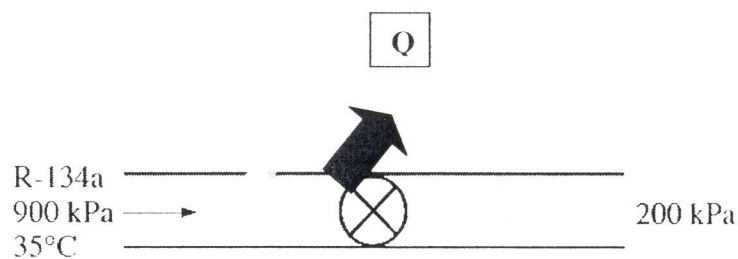


Figure Q4 A throttling valve

Question 5

An adiabatic capillary tube is used in a refrigeration system to drop the pressure of the refrigerant from the condenser pressure to the evaporator pressure. R-134a enter the capillary tube as a saturated liquid at 50°C and leaves at -12°C . Calculate:

- (a) The enthalpy (h) at the inlet and outlet of the capillary tube in kJ/kg. (4 marks)
- (b) The quality (x) of the refrigerant at the outlet of the capillary tube. (7 marks)
- (c) The entropy (s) of the refrigerant at the inlet and outlet of the capillary tube in kJ/kg. (7 marks)
- (d) The entropy generation in the capillary tube for a mass flow rate of 0.2 kg/s in kW/K. (7 marks)

END OF QUESTION