

**ME 371 Thermodynamics –I-
Second Semester, 1428-1429H
1st Midterm Exam**

Time Allowed: 90 minutes

NAME:

STUDENT ID:

Problem 1

(5 marks)

- a. (True or False) If the compressibility factor (Z) is less than 1, the fluid is not considered an ideal gas.
- b. (True or False) For ideal gases, $h = u + RT$.
- c. When a rigid tank is heated, boundary work is:
(i) positive (ii) negative (iii) zero
- d. Specific volume is:
(i) an intensive property (ii) an extensive property (iii) not a property
- e. What are the three mechanisms of energy transfer to and from a system?

NAME:

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Problem 2

(5 marks)

Complete the following table for H₂O

$T, ^\circ\text{C}$	P, kPa	$u, \text{kJ/kg}$	x	Phase Description
120		2100		
	500		0.4	
	400	4467		
180	2000			

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Problem 3

(5 marks)

A rigid tank whose volume is 1 m^3 initially contains refrigerant 134a at a pressure of 800 kPa and a temperature of 50°C . The tank is now cooled to a final temperature of 20°C .

- a. Determine the mass of refrigerant 134a.
- b. Determine the final phase of refrigerant 134a (show your work)
- c. Determine the change in specific internal energy during the process (Δu)
- d. Show the process on the T - v diagram with respect to saturation lines.

NAME:

STUDENT ID:

Problem 4

(5 marks)

A stationary piston-cylinder device contains 2 kg of air at 27°C and 100 kPa. The air is now compressed to a pressure of 500 kPa according to the relation $PV^{1.4} = \text{constant}$. Determine the following:

- a. the initial volume of air.
- b. the final volume of air.
- c. the work input during the process.
- d. the change in total internal energy of the system (ΔU) (Hint: use Table A-17)
- e. the amount of heat transfer (Q) during the process.