Name of Student: **Number of Student:**

Name of Staff Member: **TIME: - 90 MINUTES**

FIRST MIDTERM EXAMINATION
THERMAL ENGINEERING FOR INDUSTRAIL ENGINEERING STUDENTS
ME-329

QUESTION (1)

1- In thermodynamics, a fixed quantity of mass selected for the purpose of study is called a:
A) system **C)** open system
B) closed system **D)** control volume

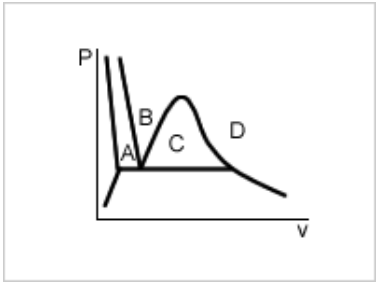
2- A specific property is also:
A) an extensive property **C)** an amount of mass dependent property
B) the product of two extensive properties **D)** an intensive proper

3- In order for a system to be in thermal equilibrium, which of the following properties must be the same throughout the system?
A) mass **C)** temperature
B) pressure **D)** volume

4- The interaction that occurs between a system and its surroundings as the system executes a process, which is the result of the system being at a temperature different from the surroundings, is:
A) Mass transfer **C)** Work transfer
B) Heat transfer **D)** None of these

5- Which one is NOT part of the total energy of a system?
A) Sensible energy **C)** Work
B) Chemical energy **D)** Thermal energy

6- In which region of the property diagram below is liquid-vapor mixture state located?
A) A **C)** C
B) B **D)** D



7- Air (c_p = 1.005 kJ/kg-k) is heated from 27°C to 327°C. How much does the specific internal energy of the air change as a result of this heating?
A) 301.5 kJ/kg decrease **C)** 215.4 kJ/kg decrease
B) 301.5 kJ/kg increase **D)** 215.4 kJ/kg increase

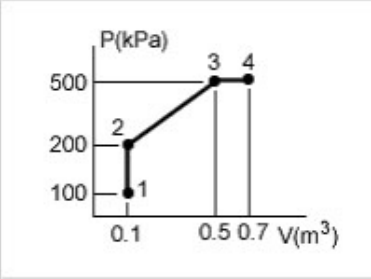
8- Oxygen (M = 32 kg/kg-mol) at 200 kPa, 27°C is contained in a piston-cylinder device arranged to maintain a constant pressure. How much work is produced by this system when it is heated to 227°C?
A) 0 kJ/kg **C)** 37.1 kJ/kg
B) 11.2 kJ/kg **D)** 52.0 kJ/kg

9- Air at 1 MPa, 27°C is contained in a piston-cylinder device that is arranged to maintain a constant pressure. How much heat is required to raise the temperature of this air to 527°C? (C_p=1.05 kJ/kg K)

A) 180 KJ/kg
B) 370 KJ/kg
C) 520 KJ/kg
D) 1040 KJ/kg

10- A closed system undergoes the series of quasi-equilibrium processes shown here. The work done is:

A) 40 kJ
B) 140 kJ
C) 240 kJ
D) 340 kJ



11- Air is compressed in an insulated piston-cylinder device. Using constant specific heats, (C_p=1.05 kJ/kg K, R=0.287 kJ/kg K). The amount of work required to compress this air from 100 kPa, 27°C to 2 MPa, 706°C is:

A) $W_{12,in}$ = 418 kJ/kg
B) $W_{12,in}$ = 518 kJ/kg
C) $W_{12,in}$ = 721 kJ/kg
D) $W_{12,in}$ = 1030 kJ/kg

(10 marks)

QUESTION (2)

Complete the table

T,^{o}C	P,kPa	v,m^3/kg	u,kJ/kg	Fluid	Quality, x
?	400	?	1825	water	?
220	?	?	?	water	1
110	?	?	?	R-134a	0.5
?	4000	?	3650	R-134a	?

(5 marks)

QUESTION (3)

A 20m^3 tank contains nitrogen at 25^{0}C and 800 kPa. Some nitrogen escapes the tank through a leakage. The leakage is stopped. The final temperature and pressure of the nitrogen in the tank is 20^{0}C and 600 kPa respectively.

(1)The initial mass of the nitrogen is ----------kg
(2)The final mass of the nitrogen is ----------kg
(3)The mass of nitrogen that leaked is ----------kg.

(5 marks)

QUESTION (4)

Fill in the blanks. (1 mark each)

(a) The vacuum gage on a tank reads 35 kPa at a location where barometer reads 760 mm of mercury. The absolute pressure in the tank is ----kPa.

(b) A 800 L rigid tank contains 10 kg of oxygen at 25^{o}C. The pressure in the tank is ---------- kPa.

(c) A fluid in a rigid tank having an internal energy of 800 kJ is stirred by a paddle wheel doing 100 kJ of work. The tank looses 500 kJ of heat to the surroundings. The change in the internal energy is----------.

(d) A tank contains a gas at 100 kPa. It is heated so that the temperature changes by 10^{o}C. The corresponding change in Kelvin scale is --------.

(e) The weight of the air of density 1.16 kg/m^3 contained in a room whose dimensions are 6mx6mx8m is----------.

(f) A rigid tank contains 10 kg of air at 200 kPa and 27^{o}C. The air is heated until its pressure doubles. The volume of the tank is----------and the amount of heat supplied to the air is----------.

(g) 5 kg of hydrogen are heated from 400 K to 1200 K. the change in internal energy of hydrogen is -------kJ and change in enthalpy is----------kJ.

(h) A 150 W fan is switched on in a room 4mx6mx6m. The room is completely insulated. The density of air is 1.22 kg/m^3. The change in the temperature of the room after 5 hours is ---- ----.

(i) Air having density of 2.21 kg/m^3 enters a nozzle steadily at 30 m/s. The inlet area of the nozzle is 80 cm^2. The mass flow rate of air is ----------.

(j) A piston cylinder contains 10 kg of air. It is heated by an electrical heater, placed outside it, that passes 5 Amperes of current for 5 minutes from a source of 120 Volts. What types of energy ii transferred and by how much?