Taif University College of Engineering Mechanical Eng. Dept.



- 1- A closed system contains 10 kg of water at 100 kPa. The liquid mass is 7 kg. Find:
  - a- Quality and specific properties for saturated liquid and saturated vapor (0.3).
  - b- Volume of liquid and vapor.  $(0.0073 \text{ m}^3, 5.082 \text{ m}^3)$
  - c- Enthalpy and internal energy. (1094.9, 1043.9 kJ/kg)
- 2- A vessel having a volume of 5 m<sup>3</sup> contains 0.05 m<sup>3</sup> of saturated liquid water and 4.95 m<sup>3</sup> of saturated water vapor at 0.1 MPa. Heat is transferred until the vessel is filled with saturated vapor. Determine the heat transfer. (104.9 MJ)
- 3- A cylinder fitted with a piston has a volume of 0.1 m<sup>3</sup> and contains 0.5 kg of water at 0.4 MPa. Heat is transferred to the water until the temperature is 300 °C, while the pressure remains constant. Determine the work and the heat transfer.

(91 kJ, 771 kJ)

- 4- A cylinder with a piston contains steam at 7 bar and 0.9 quality. The steam expands isothermally and reversibly to a pressure of 1.5 bar. The heat supplied during the process is found to be 547 kJ/kg. Sketch the process on T-v diagram and calculate the work done per kilogram of steam.
- 5- A 0.5 m<sup>3</sup> rigid tank contains R134a initially at 160 kPa and 0.4 quality. Heat is now transferred to the refrigerant until the pressure reaches 700 kPa. Determine:
  (a) the mass of the refrigerant in the tank [10.03 kg]. (b) the amount of heat transferred [2707 kJ]. Also, show the process on a P-v diagram.
- 6- A classroom that normally contains 40 people is to be air-conditioned with window air-conditioning units of 5 kW cooling capacity. A person at rest may be assumed to dissipate heat at a rate of about 360 kJ/h. There are 10 light bulbs in the room, each with a rating of 100 W. The rate of heat transfer to the classroom through the walls and the windows is estimated to be 15,000 kJ/h. If the room air is to be maintained at a constant temperature of 21°C, determine the number of window air-conditioning units required.

With my best regards Dr. Bahaa Saleh