Test 1 Warming-Up Question-Pure Substance and Ideal Gas

Question 1

Using the property tables for water, determine the specified property data at the indicated states. In each case, locate the state by hand on sketches of the ***T-υ*** and ***P-υ*** diagrams.

a) At P = 300 kPa, T = 240°C, find υ (m^3/kg) and u (kJ/kg).

b) At P = 3 bar, υ = 0.5 m^3/kg, find T (°C) and u (kJ/kg).

c) At T = 400°C, P = 1 MPa, find υ (m^3/kg) and h (kJ/kg).

d) At T = 325°C, υ = 0.03 m^3/kg, find P (kPa) and u (kJ/kg).

e) At P = 100 kPa, x = 60%, find P (kPa) and υ (m^3/kg) and h (kJ/kg).

f) At T = 100°C, P = 150 kPa, find υ (m^3/kg) and h (kJ/kg).

g) At P = 4 MPa, T = 160°C, find υ (m^3/kg) and u (kJ/kg).

h) At T = 350°C, u = 1642.4 kJ/kg, find υ (m^3/kg) and h (kJ/kg).

i) At P = 350 kPa, h = 2732.0 kJ/kg, find υ (m^3/kg) and u (kJ/kg).

Question 2

A rigid tank contains 0.5 kg oxygen gas (O_2) initially at 3000 kPa and 200 K. The gas is cooled and the pressure drops to 2000 kPa. Determine

i) the gas constant (kJ/kg.K),

ii) the number of mole (kmol),

iii) the volume of the tank (liter) and

iv) the final temperature (K).

v) Sketch the process on a ***T-V*** property diagram and label clearly the ***P-V-T*** lines.

Take for oxygen gas, R_u = 8.31443 kJ/kmol.K, M = 32 kg/kmol. Note: 1000 liter = 1 m^3.

Question 3

A piston-cylinder device initially contains 0.4 m^3 of air at 100 kPa and 80°C. The air is now compressed to 0.1 m^3 in such a way that the temperature inside the cylinder remains constant. Determine

i) the mass (kg),

ii) the molar mass (kg/kmol),

iii) number of mole (kmol), and

iv) the final pressure (kPa).

v) Sktech the process on a ***P-V*** diagram and label clearly the ***P-V-T*** lines.

Take for air, R = 0.2871 kJ/kg.K, R_u = 8.31443 kJ/kmol.K