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BS chemical Eng
III rd Semester

Q 1

(a) System :-

Anything under observation and under consideration is called a system.

Ex: A gas in cylinder

(b) Surrounding :-

Remaining portion of universe Except System is called Surrounding

Ex :

Except system

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(c) Adiabatic process :- A process in which not Heat enter or leaves the system is called Adiabatic process.

Ex: $Q = 0$

(d) Isolated system :-

The system in which energy and matter cannot Exchange, through system and Bourdries.

Ex: $\Delta Q = 0$

(e) Extensive property :-

The property which depend upon the mass and Size is called Extansive property.

Ex :

Enthalpy

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Q.2 ⟷

Given data:

Pressure = P = 7 bar

Specific Enthalpy = $\hat{H}$ = 2600 KJ/kg

Find :

Specific volume = ? = $\hat{v}$ = ?

Specific Internal Energy = $\hat{u}$ = ?

Sol:

we know that

$$\hat{h} = h_f + x h_{fg} \quad \text{---(1)}$$

$$2600 = 697.1 + x(2064.9)$$

$$\frac{2600 - 697.1}{2064.9} = x$$

$$\boxed{x = 0.921}$$

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$$\hat{v} = v_f + x\, v_{fg}$$

$$= 0.001108 + (0.92)(0.273 - 0.001108)$$

$$= 0.001108 + 0.25041$$

$$\boxed{\hat{v} = 0.2515\ m^3/kg}$$

$$\hat{u} = u_f + x\, u_{fg}$$

$$= 696.3 + (0.921)(2571.1 - 696.3)$$

$$= 696.3 + 1726.69$$

$$\boxed{\hat{u} = 2420.02\ kJ/kg}$$

Ans =

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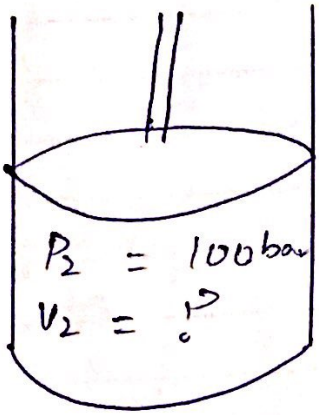

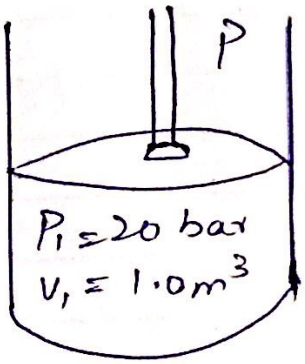

Given:

Mass = m = 10 kg

Find :-

work done = ?

Heat Transfer = ?

$$P \hat{v}^{1.5} = \text{constant}$$

As,

$$P_1 \hat{v}^{1.5} = P_1 \hat{v}_1^{1.5} = P_2 \hat{v}_2^{1.5}$$

Now we have to Find

Specific volume = $\hat{v}_1$ = ?

$$\hat{v}_1 = \frac{V_1}{m} = \frac{1}{0.1} = 0.1\ m^3/kg$$

Now,

$$P_1 \hat{v}_1^{1.5} = P_2 \hat{v}_2^{1.5}$$

$$\hat{v}_2^{1.5} = \frac{P_1 \hat{v}_1^{1.5}}{P_2}$$

$$\hat{v}_2 = \left(\frac{P_1 \hat{v}_1^{1.5}}{P_2} \right)^{1/1.5}$$

$$\hat{v}_2 = \left(\frac{2 \times (0.1)^{1.5}}{10} \right)^{1/1.5}$$

$$\hat{v}_2 = 0.0341\ m^3/kg$$

Now,

$$\hat{w} = -\int_{0.1}^{0.0342} P\, d\hat{v}$$

$$= -\int_{0.1}^{0.0342} \frac{P_1 \hat{v}_1^{1.5}}{\hat{v}^{1.5}}\, d\hat{v}$$

$$= 2 p_1 \hat{v}_1^{1.5} \left[\frac{1}{\hat{v}_2^{0.5}} - \frac{1}{\hat{v}_1^{0.5}} \right]_{0.1}^{0.0342}$$

$$\hat{w} = 284\ kJ/kg$$

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Now, Apply I^{st} law

$$q = \Delta U - w$$

$$U_1 = 2600.3 \text{ kJ/kg}$$

For U_2

$$\frac{U_2 - U(T=500)}{U(T=550) - U(T=550)} = \frac{v_2 - v(500i)}{v(T=550) - v(T=500)}$$

$$U_2 = U(T=500i) + [U(T=500)] - U(T=500)]$$

$$= \left[\frac{v_2 - v(T=500)}{v(T=550) - v(T=500)} \right]$$

$$= 3045.87 \left[3144.5 - 3045.8 \right) \left[\frac{0.0342 - 0.03279}{0.03564 - 0.03279} \right]$$

$$\boxed{U_2 = 3094.6 \text{ kJ/kg}}$$

$$q = \Delta U - w \Rightarrow (U_2 - U_1) - w$$

$$\boxed{q = 210 \text{ kJ/kg}}$$

Since

$$T_2 = 500^\circ C + [550 - 500^\circ C]\left[\frac{v_2 - v(T_2 = 550)}{v(T_2 = 550^\circ) - v(T = 500^\circ C)}\right]$$

$$= 500 + [50]\left[\frac{0.0342 - 0.03279}{0.03564 - 0.03279}\right]$$

$$\boxed{T_2 = 525^\circ C}$$

Ans

Z