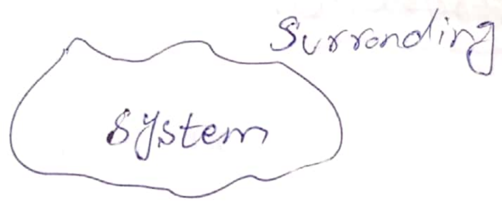
NAME :- M.Kashif Munir Reg No :- CHEN 19111014

Q :- 1

System :-

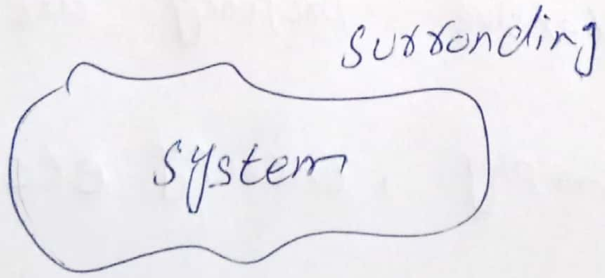
A system is defined as the anything which are kept in consideration.

Example :-



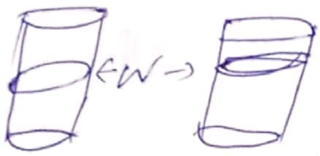
Surronding :-

It is defined as everything external to the system or without the system, is called surronding.



Adiabatic Process :-

Adiabatic process is a process of thermodynamic process in which no heat transfer occurs across the system boundary, is called adiabatic process.



$Q = 0$

Isolated ~~process~~ system :-

The system in which no mass or energy crosses the boundary, is called isolated system.

Example:- Thermo flask and cooler is example of isolated system.

Extensive Property :-

A physical property whose value is proportional or depend on the size of the system. Extensive property are additive.

Example:- Enthalphy , Entropy etc.

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Pg # 3

Q:-2

Data given

$p = 7$ bar

$\hat{h} = 2600$ kJ/kg

To find

$x = ?$ = dryness fraction

$\hat{V} = ?$ = specific volume

$\hat{u} = ?$ = specific internal energy

Solution

For dryness fraction:-

$\hat{h} = h_f + x\, h_{fg}$ By using the steam table we have

$2600 = 697.1 + x(2064.9)$

$2600 - 697.1 = x\,(2064.9)$

$1902.9 = x \cdot 2064.9$

$$x = \frac{1902.9}{2064.9}$$

$$\boxed{x = 0.921}$$

Pg #4

For specific Volume:-

$$\hat{V} = V_f + x\, V_{fg}$$

$$= 0.001108 + 0.921\,(0.273 - 0.001108)$$

$$= 0.001108 + 0.25041$$

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

For specific Internal energy:-

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

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

$$= 696.3 + 2726.69$$

$$\boxed{\hat{u} = 2420 \ kJ/kg}$$

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Q:- 3

Given data:-

$m_1 = 10$ kg of water

pressure $= P_1 = 20$ bar $= \frac{20 \text{ bar} \mid 100 \text{ kPa}}{\mid 1 \text{ bar}} = 2 \text{MPa}$

$P_2 = 100$ bar

Pv Relation $= Pv^{1.5} =$ constant are taken in question

$v_1 = 1.0 \ m^3$

To find

$\hat{W} = ?$

$q = ?$

Solution

For Workdone:-

$$\hat{W} = -\int P_E d\hat{v} = -\int P d\hat{v}$$

$$P_2 = \frac{100 \text{ bar} \mid 100 \text{ kPa}}{\mid 1 \text{ bar}} = 10 \text{MPa}$$

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$\boxed{\text{pg \#6}}$

$$P\hat{V}^{1.5} = \text{const}$$

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

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

$$\hat{V}_2 = \left[\frac{2\,\text{MPa}}{} \left| \frac{(0.1\,m^3)^{1.5}}{(kg)^{1.5}} \right| \frac{}{10\,\text{MP}}\right]^{1.5}$$

$$\hat{V}_2 = \left(\left(0.2\times10^{3}\right)^{1.5}\right)^{1.5}$$

$$\boxed{\hat{V}_2 = 0.0342\ m^3/kg}$$

$$\hat{\omega} = \int_{0.1}^{0.0342} P_E \cdot d\hat{V} = -\int_{0.1}^{0.0342} P \cdot d\hat{V}$$

$$\hat{\omega} = -\int_{0.1}^{0.0342} \frac{P_1\hat{V}_1^{1.5}}{\hat{V}^{1.5}}$$

$$\hat{\omega} = \int_{0.1}^{0.0432} \frac{0.0632}{\hat{V}^{1.5}}\, d\hat{V}$$

$$= \left[\frac{0.0632}{0.5} \left| \frac{}{\hat{V}^{1.5}} \right.\right]_{0.1}^{0.0432}$$

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pg # 7

$$= \frac{0.632}{0.5}\left[\frac{1}{(0.0342)^{0.5}} - \frac{1}{(0.1)^{0.5}}\right]$$

$$= \frac{0.2888\ \cancel{MPa}.\cancel{m^3}}{kg}\left|\frac{1000\ \cancel{kPa}}{1\ \cancel{MPa}}\right|\frac{1\ kJ}{1\ \cancel{kPa}.\cancel{m^3}}$$

$$\boxed{\hat{W} = 284\ kJ/kg}$$

For heat:-

$$\Delta\hat{u} = \hat{q} + \hat{w}$$

At state 1, $P_1 = 2MPa$, $T_1 = 213.6°C$

u_1 (kJ/kg)	T (°C)
2600	212
u_1	213
2628	225

$u_1 = 2600$ kJ/kg

At state 2, $P_2 = 10MPa$ $\hat{V}_2 = 0.0342\ m^3/kg$

~~$\hat{u}_2$~~

$\hat{u}_2$ (kJ/kg) | P0#8 | $\hat{v}_2$ (m^3/kg)

3045	0.0328
$\hat{u}_2$	0.0342
3144	0.0356

$$\hat{u}_2 = 3090.15 \text{ kJ/kg}$$

$$\Delta\hat{u} = \hat{u}_2 - \hat{u}_1$$

$$= 3090.15 \,\text{kJ/kg} - 2600 \,\text{kJ/kg}$$

$$\Delta\hat{u} = 490.15 \text{ kJ/kg}$$

$$\Delta\hat{u} = \hat{q} + \hat{w}$$

$$\hat{q} = \Delta\hat{u} - w$$

$$q = (490.15 - 284) \text{ kJ/kg}$$

$$\boxed{q = 206.15}$$

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