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Answer: no: 1

Defination:-

- System:- Anything under consideration (concentration) that have some inputs by which some process is going on and producing some output is called system.

- Adiabatic Process:- It is the process in which the system is not able to exchange mass and heat from the surrounding is called adiabatic process. but can exchange energy in the form of work.

- Surrounding:- Everything that is other then system and boundry is called surrounding.

3) **Isolated system:-**

It is the type of system in which the neither mass nor energy could be exchanged from surrounding in any form.
Example:- Vacume flask.

4) **Extensive Property:-**

It is the type of property which varies with the amount of matter change. It can be observed & measured without any chemical change (reaction) occuring.

## Answer no: 2

**Data:-**

$P = 7 bar$

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

**Calculate:-**

$x = ?$

$\hat{v} = ?$

$\hat{u} = ?$

Solution:-

as we know

$\hat{h} = h_f + x h_{fg}$

$2600 = 697.1 + x(2064.9)$

$2600 - 697.1 = x(2064.9)$

$1902.9 = x(2064.9)$

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

$\boxed{x = 0.921}$

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

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

$= 0.01108 + (0.921)(0.271892)$

$= 0.001108 + 0.25041$

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

Now

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

$= $ ~~xxxxxxxxxxxxxxxxxx~~

$\hat{u} = 696.3 + (0.921)(1874.8)$

$\hat{u} = 696.3 + 1726.6908$

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

# Answer no: 3

**Data:-**

$m = 10.0\ kg$

$P_1 = 20\ bar$

$V_1 = 1.0\ m^3$

$P_2 = 100\ bar$

$P_v$ relation $= P v^{1.5} = constt$

$T = ?$

$$P_1 = \frac{20\ bar}{1\ bar} \left| \frac{100\ kPa}{} \right. = 2000\ kPa = 2\ MPa$$

$$v_1 = \frac{1.0\ m^3}{10\ kg} = 0.1\ m^3/kg$$

by steam table at $P = 2\ MPa$

$v_f = 0.0012$ , $v_v = 0.096$

since $v_f < v_1$ at $P = 2\ MPa$

the steam is superheated.

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| $T(^\circ C)$ | $\hat{v}\ (m^3/kg)$ |
|---|---|
| 212.4 | 0.0996 |
| T | 0.1 |
| 225 | 0.1038 |

$$y = \left[(y_2 - y_1)\left(\frac{x - x_1}{x_2 - x_1}\right)\right] + y_1$$

$$T = (225 - 212.4)\left|\frac{0.1 - 0.0996}{0.1038 - 0.0996}\right| + 212.4$$

$$T = 213.6^\circ C$$

b) $\hat{W} = ?$

$$P_2 = 100\,bar\left|\frac{100\,kPa}{1\,bar}\right. = 10{,}000\,kPa = 10\,MPa$$

$\hat{V}_2 = ?$

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

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

$$\hat{V}_2 = \left[2\,MPa\left|\left(\frac{0.1\,m^3}{kg}\right)^{1.5}\right|\frac{1}{10\,MPa}\right]^{1/1.5}$$

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$$\hat{v}_2 = \left[(0.2 \times (0.1)^{1.5}\right]^{1/1.5} \ m^3/kg$$

$$= (0.2 \times 0.316)^{1/1.5} = (0.2 \times 0.316)^{0.667}$$

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

$$\hat{w} = -\int_{0.1}^{0.0342} P_E \, d\hat{v} = -\int_{0.2}^{0.0342} P \, d\hat{v}$$

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

$$P = 2 MPa \left|\left(\frac{0.1 \ m^3}{kg}\right)\right|\left|\left(\frac{kg}{\hat{v} \ m^3}\right)^{1.5}\right|^{1.5}$$

$$P = \frac{0.0632}{\hat{v}^{1.5}} \ MPa$$

$$\hat{w} = -\int_{0.1}^{0.0342} \frac{0.0632}{\hat{v}^{1.5}} \, d\hat{v}$$

$$= \frac{-0.632}{-0.5} \left| \frac{1}{0.0342^{0.5}} - \frac{1}{0.1^{0.5}} \right|$$

$$= \frac{0.2838 \ MPa \ m^3}{kg} \left| \frac{1000 kPa}{1 MPa} \right| \frac{1 kN}{1 kPa \cdot m^3}$$

$= 283.8 \text{ kJ/kg}$

$\dot{w} = 283.8 \text{ kJ/kg}$

c) $V = ?$

$\Delta \dot{u} = \dot{q} + \dot{c}v$

at state 1, $P_1 = 2 MPa$ $T_1 = 213.6^\circ C$

$u_1 = ?$

| $u_1$ (kJ/kg) | $T(^\circ C)$ |
|---|---|
| 2600.3 | 212.4 |
| $u_1$ | 213.6 |
| 2628.3 | 225 |

$u_1 = 2602.97 \text{ kJ/kg}$

at state 2 $P_2 = 10 MPa$ $\dot{v}_2 = 0.0342 \text{ m}^3/\text{kg}$

| $\dot{u}_2$ (kJ/kg) | $\dot{v}_2$ ($m^3$/kg) |
|---|---|
| 3045.8 | 0.328 |
| $\dot{u}_2$ | 0.0342 |
| 3144.5 | 0.0356 |

$\dot{u}_2 = 3095.15 \text{ kJ/kg}$

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

$= (3095.15 - 2602.97)\ kJ/kg$

$\Delta \hat{u} = 492.18\ kJ/kg$

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

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

$\hat{q} = (492.18 - 283.8)\ kJ/kg$

$\hat{q} = 208.38\ kJ/kg$

d) $T = ?$

| $T_2$ (°C) | $\hat{v}_2$ ($m^3/kg$) |
|---|---|
| 500 | 0.0328 |
| T | 0.342 |
| 550 | 0.0356 |

$T_2 = 525.0°C$