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(:- Thermodynamics :-)

QNo2:-) ~~System~~:- Solution.

$m = 10kg$

$P_1 = 20bar$

$V_1 = 1.0m^2$

$P_2 = 100bar$ $PV = PV^{1.5} = Constant$

a) $T = ?$

$$P_1 = \frac{20 \cdot 100KPa}{1bar} = 2000KPa = 2MPa$$

$$\hat{v}_1 = \frac{1.0m^3}{10kg} = 0.1m^3/kg.$$

From steam table at $P = 2MPa$

$\hat{V}_f = 0.0012$, $\hat{V}_g = 0.0996$

Since $\hat{v}_1 > \hat{v}_g$ at $P = 2MPa$

the steam is superheated

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

$$= \frac{0.2838 MPa.m^3}{kg} \cdot \frac{1000KPa}{1MPa} \cdot \frac{1KJ}{1KPa.m^3}$$

$$= 283.8 \frac{KJ}{Kg}$$

$\hat{W} = 283.8\ KJ/Kg$

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$q = ?$

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

At state 1, $P_1 = 2MPa$, $T = \cancel{216}\ 213.6°C$

$U_1 = ?$

U_1 (KJ/Kg)	T (°C)
2600	212.4
U_1	213.6
2628.3	225

$U_1 = 2602.97$ KJ/Kg

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

$\hat{U}_2$ (KJ/Kg)	$\hat{V}_2$ (m^3/Kg)
3045.8	0.0328
$\hat{U}_2$	0.0342
3144.5	0.0356

$\hat{U}_2 = 3095.15$ KJ/Kg

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

$$P\hat{V}^{1.5} = P_1 V_1^{1.5} \Rightarrow P = \frac{P_1 \hat{V}_1^{1.5}}{V_1^{1.5}}$$

$$P = 2MPa \left(\frac{0.1 m^3}{Kg}\right)^{1.5} \left(\frac{Kg}{V\, m^3}\right)^{1.5}$$

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

$\hat{W} = -\int_{0.1}^{0.0342} \frac{0.0632}{\hat{V}^{1.5}} d\hat{V}$

$= -\frac{0.0632}{-0.5} \left| \frac{1}{\hat{V}^{0.5}} \right|_{0.1}^{0.0342}$

$= -\frac{0.0632}{0.5} \left[\frac{1}{0.0342^{0.5}} - \frac{1}{0.1^{0.5}} \right]$

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

$= (3095.15 - 2602.97) \text{ KJ/Kg}$

$\Delta\hat{U} = 492.18 \text{ KJ/Kg}$

$\Delta\hat{U} = \hat{q} + \hat{W}$

$\hat{q} = \Delta\hat{U} - \hat{W}$

$\hat{q} = (492 - 283.8) \text{ KJ/Kg}$

$\hat{q} = 208.38 \text{ KJ/Kg}$

d = ?

T_2 (°C)	$\hat{V}_0$ (m^3/Kg)
500	0.0328
T	0.0342
550	0.0356

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$T_2 = 525.0°C.$

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

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

$T = 213.6°C$

$\hat{W} = ?$

$$P_2 = 100\,bar \left| \frac{100\,KPa}{1\,bar} \right. = 10000\,KPa = \cancel{10MM}\ 10\,MPa.$$

$\hat{V}_2 = ?$

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

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

$$= \left[2\,MPa \left| \left(\frac{0.1\,m^3}{Kg}\right)^{1.5} \right| \frac{1}{10\,MPa}\right]^{\frac{1}{1.5}}$$

$$= (0.2 \times 0.0316)^{\frac{1}{1.5}} = (0.2 \times 0.0316)^{0.667}$$

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

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QNo1:- **System:-**

A system surrounded and influenced
it enviroment and described by its boundaries.

Surrounding:-

The circumstances, conditions, or which
by which one is surrounded.

Adiabtic Process:-

In thermodynamics, an adiabtic proce
type of thermodynamic process which occur without t
heat or mass between the system and its surr

Isolated System:-

An isolated system does not
energy or matters with its surroundings.

Extensive Property:-

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QNO2:- Data Given

$P = 7$ bar

$h = 2600$ kJ/kg

$x = ?$

$\hat{v} = ?$

$\hat{u} = ?$

1) $\hat{h} = hf + x.hfg$

$2600 = 697.1 + x(2064.9)$

$2600 = 697.1 + x(2064.9)$

$\frac{1902.9}{2064.9} = x$ $\boxed{x = 0.921}$

2) $\hat{v} = vf + u.vfg$

$= 0.00108 + (0.921)(0.27 - 0.001108)$

$= 0.001108 + (0.921)(0.271892)$

$= 0.00108 + 0.25041$

$= 0.2515\ m^3/kg$

3) $\hat{u} = uf + x\,ufg$

$= 696.3 + (0.921)(2571.1 - 963.3)$

$= 696.3 + 1726.6908$

$= 2420$ kJ/kg

So

$\boxed{\begin{array}{l}\hat{v} = 0.2515\ m^3/kg \\ \hat{u} = 2420\ kJ/kg\end{array}}$