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Q#1
Definations

System
System is a body of matter and radiation, confined in space by walls, with defined Permeabilities, which separate it from its surroundings. Wall of thermodynamic system may be Purely national, when it is described as being Permeable to all matter all radiation and forces.

Ans:- Piston, exhaust system etc.

Surrounding
Surroundings are the area around a given Physical geographical Point or Place. In thermodynamic, everything outside the system is called surrounding.

Ans:- Air etc

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Adiabatic Process:

The process in which no heat tranfer take Place, doesn't meen that temperecture is constent, but rather that no heat is transferred into or out from the system.

Isolated system:

The system in which only forces that contribute to the momentum change of an individuel object are the forces acting between the objects themselves Can be con considered an isolated system

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Extensive Property:

It is a property of matter that changes as amount of matter changes. Like other Physical Properties. Extensive Property may be observed and measured without any chemical change or reaction occuring.

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Q#2:

Given data:

P = 7 bar

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

Required:

x = ?

$\hat{v}$ = ?

$\hat{u}$ = ?

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Solution:

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

$2600 = 697.1 + x(2064.9)$

$2600 - 697.1 = x(2064.9)$

$1902.9 = x(2064.9)$

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

$\boxed{x = 0.921}$

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

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

$= 696.3 + (0.921)(1874.8)$

$= 696.3 + 1726.6908$

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

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

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

$= 0.001108 + (0.921)(0.271892)$

$= 0.001108 + 0.25041$

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

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Q#3

Given data

$m = 10\ kg$

$P_1 = 20\ bar$

$V_1 = 1\ cm^3$

$P_2 = 100\ bar$

P_2 relation $= P_2 V^{1.5} = constant$.

Solution

$W = ?$

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

$\hat{V}_2 = ?$

$$P_1 V_1^{1.5} = P_2 V_2^{1.5} \Rightarrow V_2^{1.5} = \frac{P_1 V_1^{1.5}}{P_2}$$

$$V_2 = \frac{20\ MPa \mid \left(\frac{0.1\ m^3}{kg}\right)^{1.5} \left(\frac{1}{10\ MPa}\right)^{1.5}}{}$$

$$= \hat{V}_2 = (0.2 \times 10^{-1})^{1.5}\ m^3/kg$$

$$= (0.02 \times 0.0316)^{1/1.5}.$$

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$$V_2 = 0.0342 \ m^3/kg$$

$$\dot{w} = \int_{0.1}^{0.0342} P \cdot d\dot{v} = -\int_{0.1}^{0.342} P \cdot d\dot{v}$$

$$P\dot{v}^{1.5} = P_1 V_1^{1.5} \Rightarrow P = \frac{P_1 V_1^{1.5}}{\dot{v}^{1.5}}$$

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

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

$$\dot{w} = -\int_{0.1}^{0.342} \frac{0.0632}{\dot{v}^{1.5}} d\dot{v}$$

$$= \frac{0.0632}{-0.5} \left| \frac{1}{\dot{v}^{0.5}} \right|_{0.1}^{0.342}$$

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

$$= \frac{0.2838\,MPa\,m^3 \left| 1000\,kPa \right| \left| 1\,kN \right|}{kg \left| 1\,MPa \right| \left| 1\,kPa \cdot m^2 \right|}$$

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

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$Q = ?$

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

A 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	225

$u_1 = 2602.97\ KJ/kg$

At State 2. $P_2 = 10\,MPa$, $\hat{v}_2 = 0.0342\ m^3/kg$

$\hat{u}_2$ (KJ/kg)	$T(^\circ C)$
3045.8	0.0318
$\hat{u}_2$	0.0342
3144.5	0.0356

$\hat{u}_2 = 3095$

$\Delta \hat{U} = \hat{u}_2 - u_1$

$(3095.15 - 2602.97)\ KJ/kg$

$\Delta \hat{U} = 492.18\ KJ/kg$

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$$\Delta U = q + w$$

$$q = \Delta u - w$$

$$\hat{q} = (482.18 - 3483.8)\ kJ/kg$$

$$\boxed{\hat{q} = -3001.62\ kJ/kg}$$

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$T = ?$

T_2 (°C)	$\hat{v}_2$ (m^3/kg)
500	0.325
T	0.0342
550	0.0356

$$\boxed{T_2 = 515.0°C}$$

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