#### **Department of Chemical Engineering**



# Mid Term paper Muhammad Waqas CHEN19111009

Submitted to

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for

Thermodynamics-I (CHEN-2102)

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### Q# 2

Compute Specific volume and specific Internal Energy of Steam at 7 bar and Specific Enthalphy 2600 kJ?

## Sol:

Given

Pressure = P = 7 bar Specific Enthalphy =  $\hat{h} = 2600 \frac{kJ}{kg}$ 

Need to Find

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

Speafic Internal Energy = û = ?

To Find specific volume we have to find First dryness fraction 'n"

Dryness graction = n = ?

From Sturated steam table @ 7 bar and 2600 ht specific

Enthalpy, we have  $Specific Enthalpy of Liquid = \hat{h}_f = 697 \frac{kJ}{kg}$   $Specific Enthalpy of vaportation = <math>\hat{h}_f = 2067 \frac{kJ}{kg}$  Given total specific Enthalpy of steam =  $\hat{A} = 2600 \frac{kJ}{kg}$ 

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For dryners fraction (for wel steam)

$$\hat{H} = h_{Y} + n \hat{h}_{Y}g$$

$$\Rightarrow \mathcal{H} = \frac{\hat{h} - \hat{h}_{Y}f}{h_{Y}g}$$

$$putting values in above equation

$$\mathcal{H} = \frac{2600 \frac{kJ}{kg} - \frac{697 kJ}{kg}}{2067 kJ}$$

$$\mathcal{H} = 0.921$$
For Specific volume

$$\hat{V} = \mathcal{H} \hat{V}_{g}$$

$$\Rightarrow \text{From steam table } (2.7 \text{ bar and } 2600 \frac{kJ}{kg}) \text{ of } \hat{h}_{g}$$

$$\hat{V} = (0.921) \times (0.2728 \frac{m^{2}}{kg})$$
For Specific Internal Energy
For steam table (2.7 bar and 2600 \frac{kJ}{kg}) of \hat{h}_{g}$$
For specific Internal Energy
For steam table (3.7 bar and 2600 \frac{kJ}{kg})

lave = Specific Internal Energy of Liquid = Ûy = 696 \frac{115}{119}

\$\int \hat{U}\_f = \text{Specific Internal Energy of Vapours = \hat{U}\_g = 2573 \frac{k5}{kg}}\$

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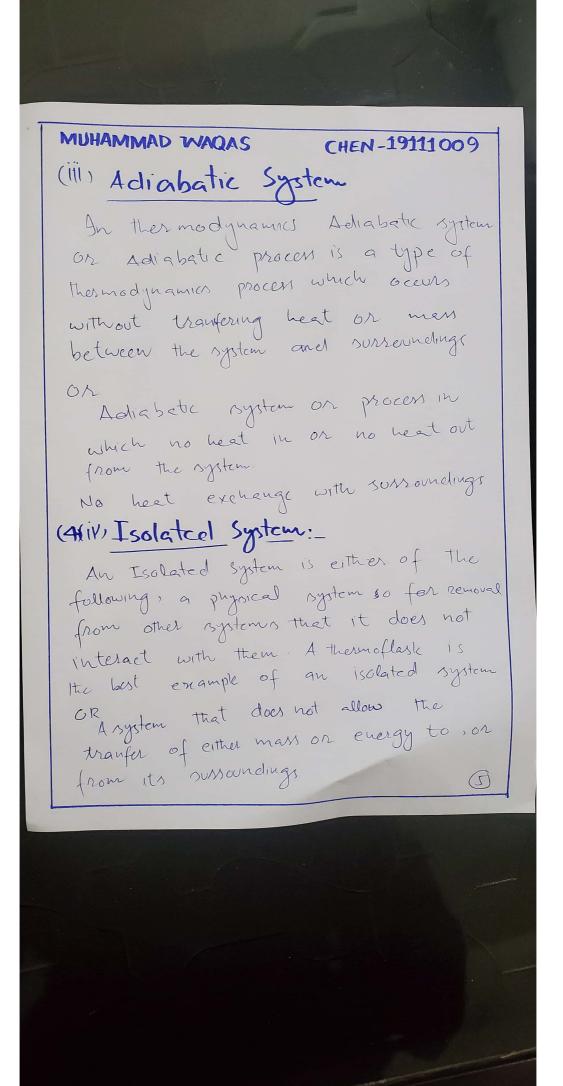
Specific Internal Energy
$$\hat{U} = (1-n)\hat{U}_f + n \hat{U}_g$$
Putting value
$$= (1-0.921)696 \frac{kJ}{kg} + (0.921)(2573 \frac{kJ}{kg})$$

$$= 55\frac{kJ}{kg} + 2365 \frac{kJ}{kg}$$

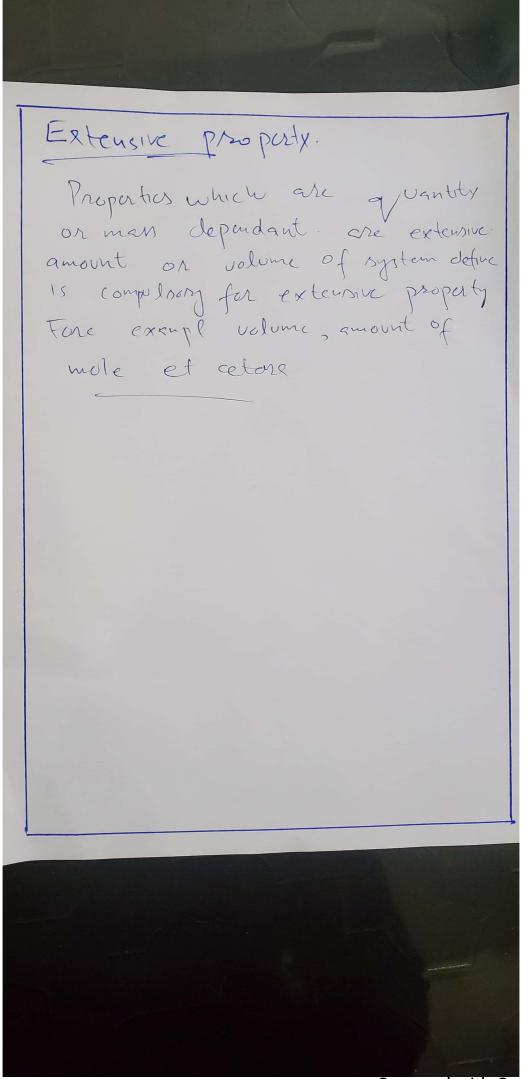
$$\Rightarrow \hat{U} = 2420 \frac{kJ}{kg}$$

## MUHAMMAD WAQAS CHEN-19111009 Q#1 (i) System A system is set of substances and energy that is beign studies or under Consideration for example, raction are occurring in a jar, everthing insid the jar is system, or the Region of universe in which we are intrested and Rest universe will be surrounding. (ii) Surroundings:-Except the system under consideration every thing in the universe is someonding Somounding is everthing else that OR not defined by system. Across system boundary other things are sursoundings.

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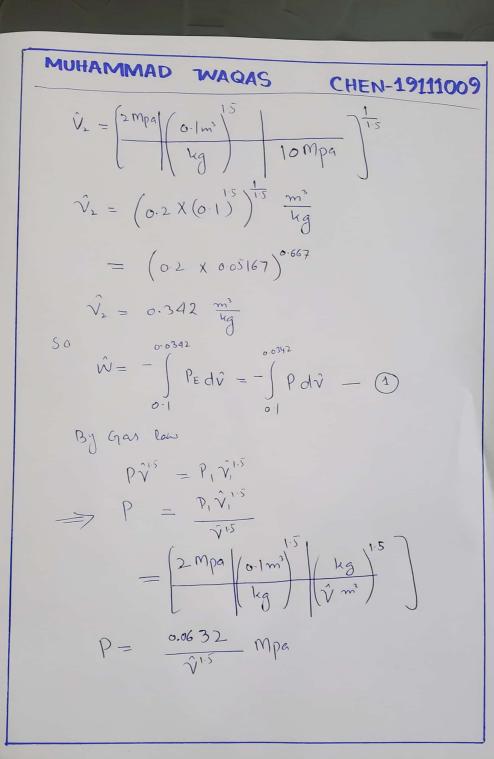
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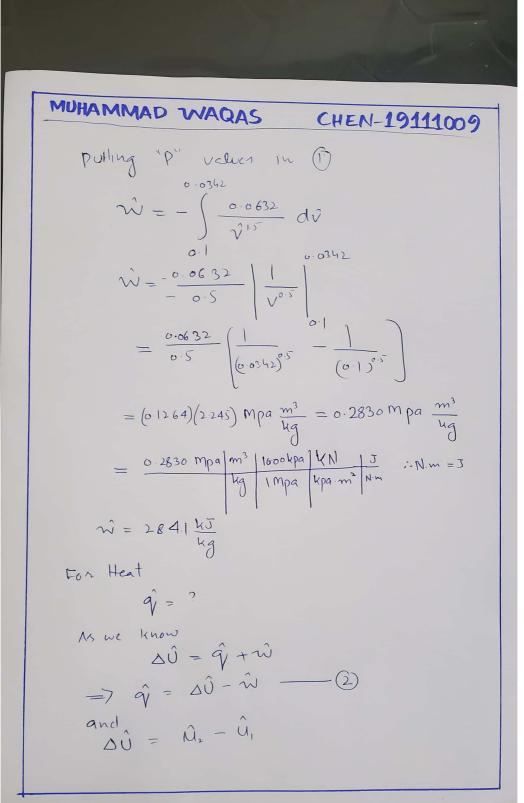
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# MUHAMMAD WAQAS CHEN-19111009 Solution Mass of Waterine 10 kg Initially pressure = P1 = 20 bax = 2 Mpa State 1 volume = V1 = 1 0 m3 State 2 Pressure or final pressure = Pz = loo bar = 10 Mpa P 21.5 = const As $work = \hat{w} = ?$ Heat = $\hat{q}$ = ? For work $\hat{W} = -\int P_{E} d\hat{v}$ By gas law $P_{1}\hat{V}_{1}^{1/5} = P_{2}\hat{V}_{2}^{1/5}$ $\Rightarrow \hat{V}_{2} = \left(\frac{P_{1}\hat{V}_{1}^{1/5}}{P_{2}}\right)^{1/5}$

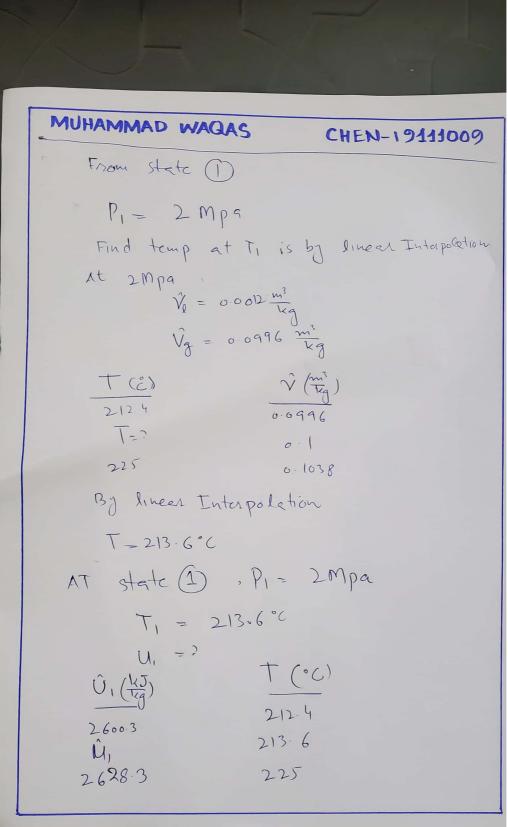


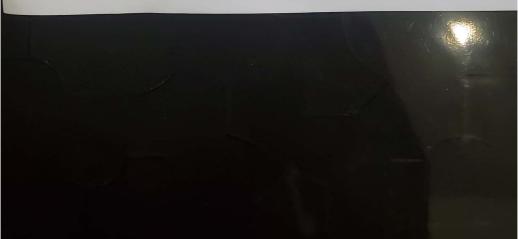






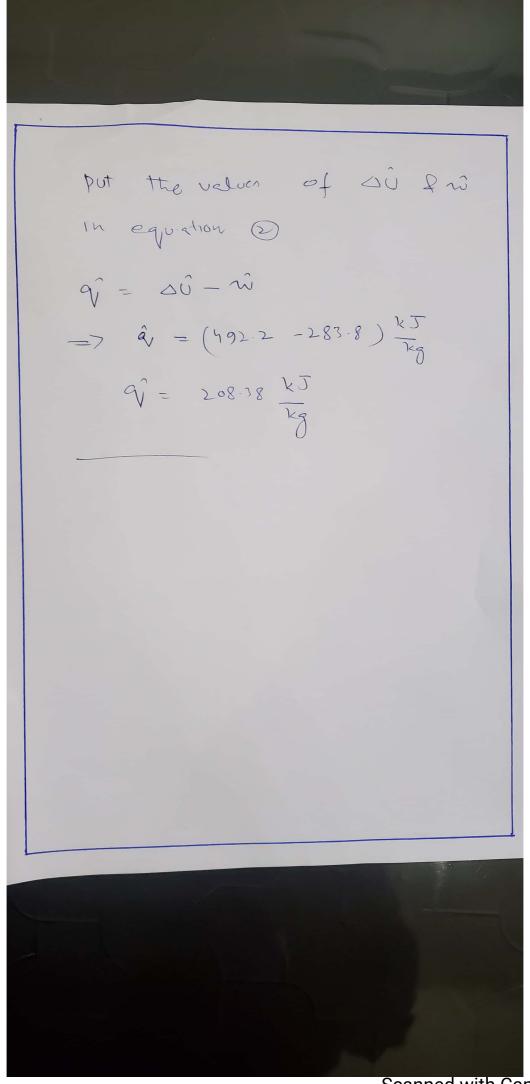






MUHAMMAD WAQAS	CHEN-19111009
By Linear Interpol	eton
Û4 = 2602.99	
For State (2)	
@ P = lo Mpa	3 ) V2= 0 0342 m3
ÜZ KJ	√2 (m²/2g)
3045.8	6.6328
û,	0.0342
3144.5	0.0356
By Inter polation	V
$\hat{U}_2 = 3095.15$	K J Kg
50 DÛ = U2 - U1	U
$\Delta U = U_2 - U_1$	2662 99 KJ)
= ( >0 /2 Kg	- 2602 99 KJ Teg
429.2	() Ng
	0





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