Department of Electrical Engineering
Mid-term exam
Date: 24/08/2020

Course Details

Course Title:	Thermodynamics	**Module:**	02
Instructor:	Sir Mujtaba Ihsan	**Total Marks:**	30

Student Details

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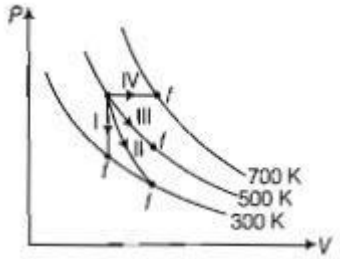
Q1.	(a)	**Express** the temperature of 140 °C on degree Fahrenheit, Rankine and Kelvin scales.	Marks 06 +05
	(b)	**Formulate** the equation highlighting the work done by a gas or vapour in expanding for a constant temperature process.	CLO 1
Q2.		**Analyze** the given figure and match column 1 with the correct option of column 2. 	Marks 08 CLO 1
Q3.	i. ii.	**Outline** the differences between work and heat. **Describe** the **meaning of the term ΔQ = ΔW**	Marks 03+03 CLO 1
Q4.		**Explain** the process of throttling.	Marks 05 CLO 1

Column 1	Column 2
Process I	Adiabatic
Process II	Isobaric
Process III	Isochoric
Process IV	Isothermal

Q 1 (a)

Express the Temperature of 140°C on degree Fahrenhite Rankin and Kelvin Scale.

Solution:

°C = 140°C

Sol:

$K = {}^{\circ}C + 273$

$K = 140 + 273$

$K = 413$ Ans

$R = 1.8\ K$

$R = 1.8 \times 413$

$R = 743.4$ Ans

$R = F + 460$

$R - 460 = F$

$F = 743.4 - 460$

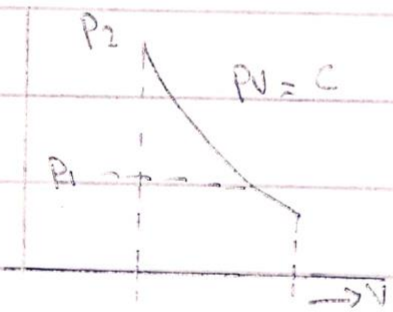
$F = 283.4$

Q1 Part (B):

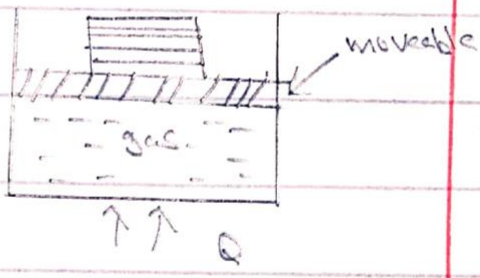
Formulate the equation highlighting the work done by a gases or vapour in expending for a constant temperature process

Ans:

In this case the gas will expend doing external work equal to the amount of heat supplied



(PV - Diagram)



Mathematically

$$W = \int_{V_1}^{V_2} P\,dV \quad \text{---- (i)}$$

As

$$P_1 V_1 = P_2 V_2 = PV = C \quad \text{---- (a)}$$

(3)

$$P = \frac{C}{V}$$

equation (1) become

$$W = \int_{V_1}^{V_2} \frac{C}{V}\, dV$$

$$= C \ln V \Big|_{V_1}^{V_2}$$

$$W = C \ln\left(\frac{V_2}{V_1}\right)$$

As $PV = C$

$$W = P_1 V_1 \ln\left(\frac{V_2}{V_1}\right)$$

Q 2) The given figure and match Column I With the correct option of Column 2

Column I	Column 2
Process I	ISChoric
Process II	Adibatic
Process iii	Isothermal
Process iv	Isobaric

Q 3 Part (i)

The difference b/w Work and Heat

1) Heat and Work both are transient Phenomen System never Pocess them but either or both Cross the System boundary Whenever a System undergoes Change of State.

2) Both heat and Work are boundary Phenomenon both are observed only at the boundary and represent energy Crossing the boundary

3) Both heat and Work are Path function and only depend upon the Path followed by a System

Q3 Part (B):

Describe the meaning of the term $\Delta Q = \Delta W$

The amount of heat required to raise the temperature of Unit mass of a gass through one degree rise in temperature at the Constant Value it is denoted by CV

For air $C_V = 0.171$ C.h.u / lb-k

As Volume is Kept Constant

S. $\Delta V = 0$

As

~~$\Delta W = 0$~~

$\Delta W = P \Delta V$

So

$\Delta W = 0$

As from the first law of thermo

$\Delta Q = \Delta W^{0} + \Delta U$

$\Delta Q = \Delta U$

Q 4) Explain the Process of throttling

Ans:

Def:.

This type of expansion occurs when a gas or vapour is expended through an aperture of minute dimensions such as a narrow throat or a slightly opened valve.

Explanation

It should be noted that frictional resistance of a fluid in passing through a pipe, varies inversly with the fifth power of the pipes ~~dia~~ diameter.

$$\text{Velocity} \propto \frac{1}{d^5}$$

During a throttling process no heat is supplied or rejected no external work is done and in the case of a

Perfect gas, there is no alteration in the temperature. Hence, throttling is an expension under condition of constant total energy.