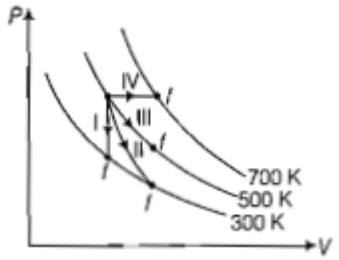
# Department of Electrical Engineering
# Assignment
# Date: 20/04/2020

## Course Details

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

## Student Details

**Name:** Abdullah **Student ID:** 16194

<table>
<tr><td rowspan="2">Q1.</td><td>(a)</td><td>Express the temperature of 139 °C on degree Fahrenheit, Rankine and Kelvin scales.</td><td>Marks 06</td></tr>
<tr><td></td><td></td><td>CLO 1</td></tr>
<tr><td rowspan="2"></td><td>(b)</td><td>Derive the equation highlighting the work done by a gas or vapour in expanding for a constant temperature process.</td><td>Marks 05</td></tr>
<tr><td></td><td></td><td>CLO 1</td></tr>
<tr><td rowspan="2">Q2.</td><td rowspan="2"></td><td rowspan="2">Analyze the given figure and match column 1 with the correct option of column 2.


<table>
<tr><th>Column 1</th><th>Column 2</th></tr>
<tr><td>Process I</td><td>Adiabatic</td></tr>
<tr><td>Process II</td><td>Isobaric</td></tr>
<tr><td>Process III</td><td>Isochoric</td></tr>
<tr><td>Process IV</td><td>Isothermal</td></tr>
</table></td><td>Marks 08</td></tr>
<tr><td>CLO 1</td></tr>
<tr><td rowspan="2">Q3.</td><td>(a)</td><td>Hydrogen is compressed under a constant pressure of 5760 lb/ft$^2$ until its volume is reduced from 28 to 12 ft$^3$. Calculate the work done in compressing the gas.</td><td>Marks 07</td></tr>
<tr><td></td><td></td><td>CLO 1</td></tr>
<tr><td></td><td>(b)</td><td>Differentiate between enthalpy and entropy using examples from daily life.</td><td>Marks 04</td></tr>
<tr><td></td><td></td><td></td><td>CLO 1</td></tr>
</table>

Q no 1: (part a)

Ans: Given data:

$C = 139\ ^{o}c$

1. Fahrenheit scale:

We know that

$F = (1.8 * C) + 32$

$F = (1.8 * 139) + 32$

$F = 250.2 + 32$

$F = 282.2\ ^{o}f$

2. Kelvin scale:

We know that

$K = C + 273$

$K = 139 + 273$

$K = 412\ ^{o}k$

3. Rankin scale :

We know that

$R = (1.8)\ k$

$R = (1.8)(412)$

$R = 741.6\ ^{o}R$

**Q no 1. (part b)**

**Ans 1:**

Work done by a gas or vapours in expending:-

The amount of work done in a gas or vapours in expending defined on the method by which expansion is perform.

As,

$$W = \int p \Delta v$$

Constant temperature

$$W = \int_{v_1}^{v_2} p dv$$

As $p_1 v_1 = p_2 v_2 = pv = c$

$$p = \frac{c}{v}$$

$$W = \int_{v_1}^{v_2} p dv$$

$$= \int_{v_1}^{v_2} \frac{c}{v} dv$$

$$= c \text{ In } v \int_{v_1}^{v_2}$$

$$= c \text{ In } \left( \frac{v_2}{v_1} \right)$$

$$Work = p_1 v_1 \text{ In} \left( \frac{v_2}{v_1} \right)$$

Q NO 2:

ANS :

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

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Q NO 3. (part a)

Ans :

Given data:

$P = 5760\ ib/ft^3$

$V_1 = 28\ ft^3$

$V_2 = 12\ ft^3$

Required :

Work done = ?

Solution:

We know that

Work done = $-P\Delta V$

Work done = $-P(v_2-v_1)$

Work done = $-5760(12-28)$

Work done = $-5760(-16)$

Result:

| Work done = 92160 j |
|---|

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Question no .3

Ans : **Difference Between Enthalpy and Entropy:**

| Enthalpy: | Entropy: |
|---|---|
| 1. Def: enthalpy is equal to the total internal energy of the system plus the product of pressure and volume. | 1. Def: entropy is the measure of a system's thermal energy per unit temperature that is unavailable for doing work |
| 2. It is represented as $\Delta H=\Delta E+P\Delta V$. | 2. It is represented as $\Delta S=\Delta Q/T$ |
| 3. Enthalpy is a kind of energy. | 3. Entropy is a property. |
| 4. It is the sum of internal energy and flow energy. | 4. It is the measurement of randomness of molecules. |

| | |
|---|---|
| 5. It unit is $Jmol^{-1}$. | 5. It unit is $JK^{-1}$. |
| 6. It related is applicable in standard conditions. | 6. It does not have any limits or conditions. |
| 7. example:<br><br>Refrigerator compressors and chemical hand warmers are both real-life examples of enthalpy.<br>Both the vaporization of refrigerants in the compressor and the reaction to the iron oxidation in a hand warmer generate a change in heat content under constant pressure. | 7. example:<br><br>A campfire is an example of entropy. The solid wood burns and becomes ash, smoke and gases, all of which spread energy outwards more easily than the solid fuel. |