Department of Electrical Engineering
Sessional Assignment
Date: 06/05/2020

Course Details

Course Title: Thermodynamics **Module:** 02
Instructor: **sir. Mujtaba Ihsan** **Total Marks:** 20

Student Details

Name: **M. Salman Nasir** **Student ID:** **16664**

Q1.		Let the initial volume of the gas in a container be 06 liters and the initial pressure be 04 atm. The piston is compressed at a constant temperature to a new final volume of 2.50 L. **Evaluate** the final pressure in units of atm, mmHg and psi.	Marks 06 CLO 2
Q2.		**State** the following statement as **True** or **False** and also give the reason for your answer: "There is a direct relationship between air pressure and altitude".	Marks 03 CLO 2
Q3.		A volume of 8 ft^3 of steam at a pressure of 100 lb-f/in^2 is expanded hyperbolically to a pressure of 18.3 lb-f/in^2 **Calculate** the work done by steam.	Marks 06 CLO 1
Q4.	i. ii.	**Outline** the differences between work and heat. **Describe** the meaning of the term $\Delta Q = \Delta W$	Marks 03+02 CLO 1

Answer no 1:

Given data:

Initial volume of the gas (v1) = 06 liter

Final volume of gas (v2) = 2.50 liter

Initial pressure (p1) = 04 atm

Find:

Final pressure (p2) in units of atm, mmHg and psi.

Solution:

According to Boyle's law

P1 v1 = p2 v2

P2 = $\frac{p1\ v1}{v2}$

p2 = $\frac{4 \times 6}{2.50}$

p2 = $\frac{24}{2.50}$

p2 = 9.6 atm

p2 = 9.6 atm

Now in mmHg

As weknow that

1 atm = 760mmHg

9.6 atm = 9.6 × 760 mmHg

9.6 atm = 7296 mmHg

P2 = 7296 mmHg

In psi

As we know

1 atm = 14.7 psi

9.6 atm = (9.6) (14.7)

9.6atm = 141 psi

P2 =141 psi

Results

P2 = 9.6 atm =7296 mmHg = 141 psi

Answer no 2 :

"There is a direct relationship between air pressure and altitude".

The above statement is wrong because the atmospheric pressure is decreases with altitude.

The higher you go, the less the pressure. The atmospheric pressure at sea level, the pressure of the atmosphere is 14.7 pounds per square inch (psi) /1 atm. At 18,000 feet the pressure is 7.34 psi. By 34,000 feet, the pressure is reduced to one-half the value at the 18,000 foot level 3.62 psi. The relation of pressure and altitude is clear from the boiling point of water or other substances we know that boiling point of any substance depend upon atmospheric pressure .AS the boiling point is the point at which internal pressure of liquid became equal to atmospheric pressure and the liquid start boiling or converting into vapors.

Now from the experimental result the boiling point of water at sea level (14.7 psi/ 1atm) is 100 degree Celsius but at muree hills (2291 meter from sea level and atmospheric pressure of 0.92 atm) is decrease to 98 degree Celsius. So from above its clear that the atmospheric pressure decrease with altitude .so there is inverse relation between air pressure and altitude not direct.

Answer no 3 :

Given data

volume v1 = 8 ft^3 = 0.226 m^3

v1 =0.226 m^3

pressure p1 = 100 lb-f/in^2 = 689475.7 pascal

P1 = 689475.7 pa

final pressure p2 = 18.3 lb-f/in^2 = 126174.05 pascal

p2 = 126174.05 pa

find

work = P Δv

ΔW = P (v2 –v1)…….(i)

In order to find work we need v1 and v2 so final volume V2 is not given so first we have to find v2

From boyle's law

P1v1 =p2v2

$V2 = \frac{p1\ v1}{p2}$

$V2 = \frac{689475.7 \times 0.226}{126174.05}$

V2 =1.23 m^3

We know that work is done by change in pressure so

Δp = p2 – p1

ΔP = 126174.05 - 689475.7

ΔP = -563301.65 pa

Now put these value in equation (i)

ΔW = P (v2 –v1)

ΔW = -563301.65 pa (1.23 m^3 - 0.226 m^3)

ΔW = - 563301.65 pa (1.004 m^3)

ΔW = 565554 j

ΔW = 0.565 MJ

The work done is equal to 0.565 mega joule

Answer no 4

Part i

Heat and work

Heat is form of energy which transfer from one body to another body due to temperature different between them (from higher temperature to lower). Heat is the transfer of thermal energy between two bodies.

While work is said to be done if a force displace body a body in its own direction.

In work done energy is also transfer to the body but its mechanical energy.

Work and heat are the two most important theories in thermodynamics. Work and Heat are highly related but they are not the same.

1. The main deference that in heat thermal energy is transfer but in work mechanical energy is transfer.
2. Heat depend up on state of system while work depend upon path followed by the system while changing state
3. Heat is interaction due to temperature different while work is interaction by reason rather than temperature different
4. Efficiency of transfer of work to heat is high but efficiency of transfer of heat to work is low

Part ii

Meaning of the term ΔQ = ΔW

The equation ΔQ = ΔW show isothermal process because from the first law of thermodynamic we know that

ΔQ = ΔU ΔW

In this equation ΔQ = heat supply to system, ΔU = internal energy and

ΔW = wo0rk done

Now in isothermal process the system undergo change in such way that the internal energy of system ΔU remain constant.

ΔU =0 now the equation becomes

$\Delta Q = (0)\ \Delta W$

$\Delta Q = \Delta W$

This equation show that that the internal energy of system remain same does not change and total heat supply done a useful work on system.