

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

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|----|-----|---|-------------|
| 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. | Outline the differences between work and heat. | Marks |
| | ii. | Describe the meaning of the term $\Delta Q = \Delta W$ | 03+02 |
| | | | CLO 1 |

Answer no 1:

Given :

Initial volume of the gas (v_1) = 06 liter

Final volume of gas (v_2) = 2.50 liter

Initial pressure (p_1) = 04 atm

Final pressure (p_2) =?.

Solution:

According to Boyle's law

$$P_1 v_1 = p_2 v_2$$

$$P_2 = \frac{p_1 v_1}{v_2}$$

$$p_2 = \frac{4 \times 6}{2.50}$$

$$p_2 = \frac{24}{2.50}$$

$$p_2 = 9.6 \text{ atm}$$

Now in mmHg

$$1 \text{ atm} = 760 \text{ mmHg}$$

$$9.6 \text{ atm} = 9.6 \times 760 \text{ mmHg}$$

$$P_2 = 7296 \text{ mmHg}$$

In psi

$$1 \text{ atm} = 14.7 \text{ psi}$$

$$P_2 = (9.6) (14.7)$$

$$P_2 = 141 \text{ psi}$$

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 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 $\Delta Q = \Delta W$

The equation $\Delta Q = \Delta W$ show isothermal process because from the first law of thermodynamic we know that

$$\Delta Q = \Delta U + \Delta W$$

In this equation $\Delta Q =$ heat supply to system, $\Delta U =$ internal energy and

$$\Delta W = \text{work done}$$

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

$\Delta U = 0$ now the equation becomes

$$\Delta Q = \Delta W$$

$$\Delta Q = \Delta W$$

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.