M T W T F S

Date: ①

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THERMODYNAMICS

MID TERM

Q1

Express the temperature 139°c

→ Fahrenheit
→ Rankine
→ Kelvin.

Data

T = 139°c

F = ?

K = ?

R = ?

Solution: →

$\overset{\circ}{F} = 1.8\,\overset{\circ}{c} + 32$

$= 1.8(139) + 32$

$T(F) = 282.2$

→ Kelvin = °c + 273

$282.2 + 273$

$T(K) = 555.2$

→ Rankin = 1.8 K

$= 1.8(555.2)$

$T(R) = 999.36$

Q1 (B)

Derive the equation highlighting the work done by a gas or vapour in expanding for a constant temperature pressure.

Expanding :- The amount of work done by gas or vapour is expanding depends on the method by which expansion is performed.

As

$$W = \int P \Delta V$$

The expression will be used in all the following cases.

Constant volume :→

As there is no change in volume so there will be no work done.

$$W = \int P \Delta V$$

As $\Delta V = 0$

$$W = 0$$

Constant Pressure :→

$$W = \int_{V_1}^{V_2} P dV$$

$$W = P(V_2 - V_1)$$

P is constant.

Constant Temperature :→

As

$$W = \int_{V_1}^{V_2} P\,dv$$

As

$$P_1V_1 = P_2V_1 = PV = C$$

$$w = P = C/V$$

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

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

$$C \ln (V_2/V_1)$$

$$\text{work} = P_1V_1 \ln (V_2/V_1)$$

~~Hydro~~ Hyperbolic Process :→

~~Work = $P_1V_1 \ln (V_2/V_1)$~~

~~Deri~~

As

$$P_1V_1 = P_1V_2 = PV = C$$

$$w = P = C/V$$

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

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

work done $= P_1 V_1 \ln(V_2/V_1)$

(5) Polytropic Process :-

$$PV^n = C$$

$$W = \int_{V_1}^{V_2} P\,dV \quad \text{---} (1)$$

Now

$$P = C/V^n$$

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

$$= C \left. \frac{V^{-n+1}}{-n+1} \right|_{V_1}^{V_2}$$

$$= C \left. \frac{V^{1-n}}{1-n} \right|_{V_1}^{V_2}$$

$$W = \frac{C\left[V^{1-n} - V_1^{1-n}\right]}{1-n}$$

$$W = \frac{P_2 V_2^n V_2^{1-n} - P_1 V_1^n V_2^{1-n}}{1-n}$$

$$W = \frac{P_1 V_1 - P_2 V_2}{n-1}$$

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(6) Adiabatic Process.

$$W = \frac{P_1V_1 - P_2V_2}{\gamma - 1}$$

(7) Free expansion.

As free expansion is unresisted there will be no external work done.

$$W = 0$$

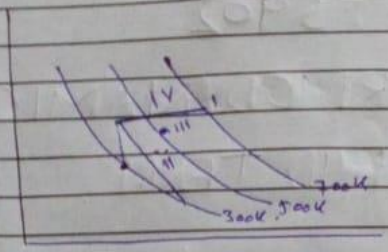
(8) Throttling:

No external work is done by fluid in the process.

$$W = 0$$

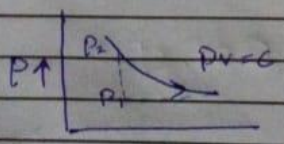
Date:

Q2

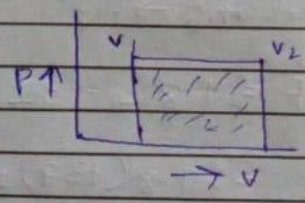


column 1	column 2
Process I	Adiabatic
Process 2	Isobaric
Process III	Isochoric
Process IV	Isothermal

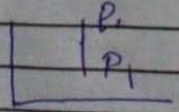
Isothermal



Isobaric



Isochoric



Q3 (a).

Hydrogen is compressed pressure $5760 lb/ft^2$ unitil its volume 28 to $12 ft^3$

calute the work done in compressig the gas.

$P = 5760 \ lb/ft^2$

$V_2 = 28 \ ft^3$

$V_1 = 12 ft^3$

$P(V_2 - V_1)$

$5760 (28 - 12)$

$5760 (16)$

work dw = $92,160$ ft-lbf

Q3 (b)

Entropy :-

* The measure of change in enthalpy / temperature.
* Entropy is thus a measure of the random activity in a system.
* Entropy is a property.
* It is measurement of randomness of molecules.
* It is denoted by symbol S.

Enthalpy :→

* Enthalpy is a measure of heat content of the system.
* Enthalpy is a kind of energy.
* It is sum of internal energy and flow energy.
* It is denoted by symbol H.

Abdul Wahab Paper