

THERMODYNAMICS

8.00

Thermodynamics

9.00

Heat

Motion

10.00

Heat in Motion

11.00

Thermodynamics in which deals with the Energy Transfer.

12.00

1.00

(i) Macroscopic (ii) Microscopic

↓

↓

2.00

Large

Small

↓

↓

3.00

gps of Molecules

Single molecules

↓

↓

4.00

Under the human sense)

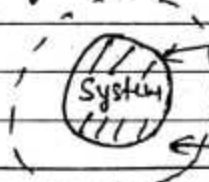
Static Thermodynamics

↓

classical Thermodynamics

6.00

System :- System can be defined as the region in space on which Thermodynamics Analysis focus.



Boundary

Surrounding Environment

एकता और मानवता का आधार ईश्वर का ज्ञान है।

05

Wednesday

2011

JANUARY

Day : 005-360

Wk : 02

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Any think Out side is Surrounding

8.00

9.00

Boundary

10.00

Fixed Boundary

Moving Boundary

11.00

System

12.00

1.00

Open System

Close System

Isolated System

2.00

(i) Open System

3.00

4.00

5.00

6.00

Mass

Open System

mass

Energy

Energy

Evening

Eg - (i) Internal Combustion Engine

(ii) Flow Through the gas

(iii) Air Compression

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2011
 JANUARY

Thursday

06

Wk : 02 Day : 006-359

(ii) Close System :-

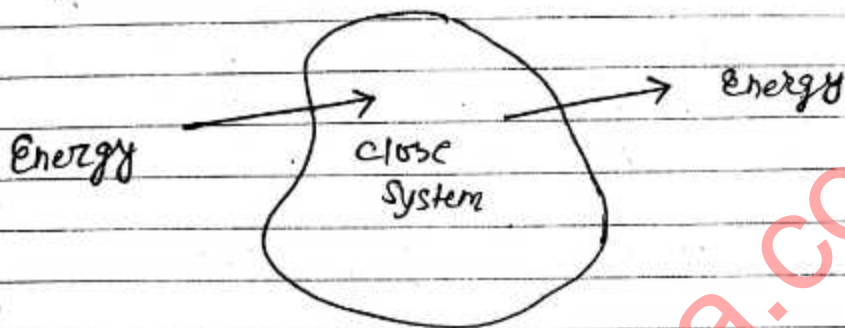
8.00

9.00

10.00

11.00

12.00



e.g → piston and cylinder

(iii) Isolated System :- Neither Mass and Energy transfer. Mass of always Energy Constant.

2.00

e.g - Universe.

3.00

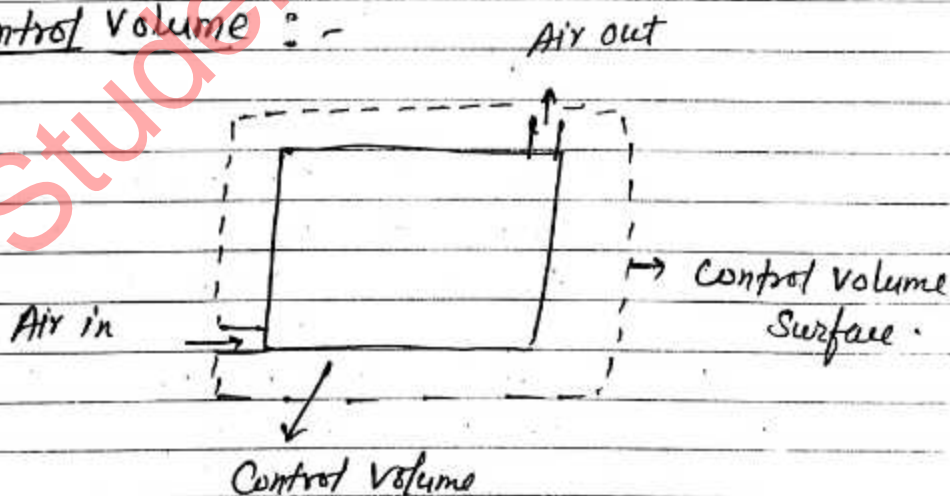
Control Volume :-

4.00

5.00

6.00

Evening



07

Friday

2011

JANUARY

Day : 007-358 Wk : 02

January		2011			
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8.00 Thermodynamic properties :- Every System passes these characteristics are known as Thermodynamic properties, e.g Pressure, volume, Temperature (PVT).

10.00

11.00

Types of Thermodynamic properties

12.00

1.00

(i) Intrinsic properties / Intensive properties → property is independent of Mass Such as Temperature, pressure etc.

2.00

(ii) Extensive properties :- Dependent of Mass.

3.00

Specific Quantities :-

4.00

$$v = \frac{V}{m}$$

5.00

6.00

Homogenous / Heterogenous Substances :- A Substance which exists in a single phase is known as Homogenous Substances.

Evening

A Substance which exists in a two multiple phase is known as Heterogeneous Substances.

process → path, cycle.

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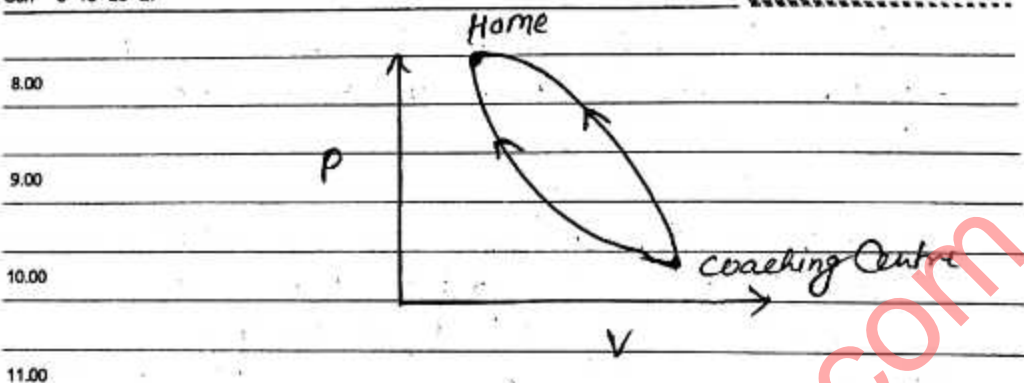
2011
 JANUARY

Saturday

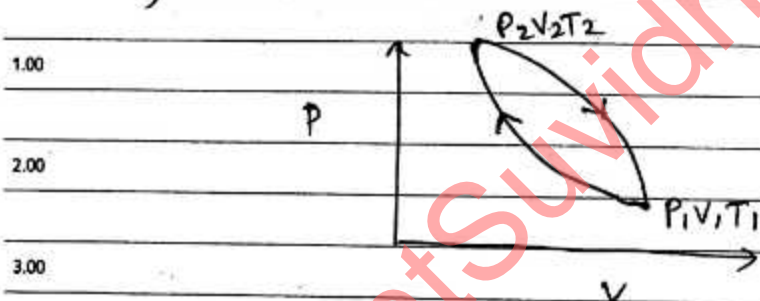
08

Wk : 02

Day : 008-357



In a process in which initial state is final state then has a executed.



Thermodynamic Equilibrium :- A system is set to be equilibrium when a go for spontaneously process.

- (i) chemical Equilibrium.
- (ii) Mechanical Equilibrium.
- (iii) Thermal Equilibrium.

Sunday 9

(i) Chemical Equilibrium :- No chemical and transfer of Metal transfer from One part to another part.

10

Monday

2011

JANUARY

Day : 010-355

Wk : 03

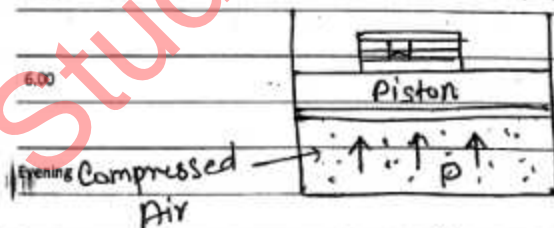
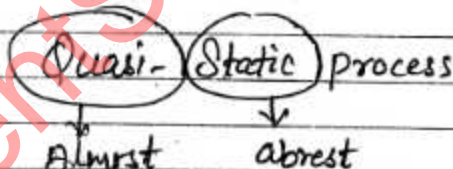
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(ii) Mechanical Equilibrium :- Absence of unbalance forces within the system & surroundings.

(iii) Thermal Equilibrium :- when both chemical & mechanical achieve with shape & size through a thermic wall (in which heat can flow) and spontaneous change occurs. Then it is said that thermal equilibrium.

Note - An isolated system always remains constant.

Quasi-static process :-



Imbibe the spirit of service to serve God.

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2011
JANUARY

Tuesday

11

Wk: 03

Day: 011-354

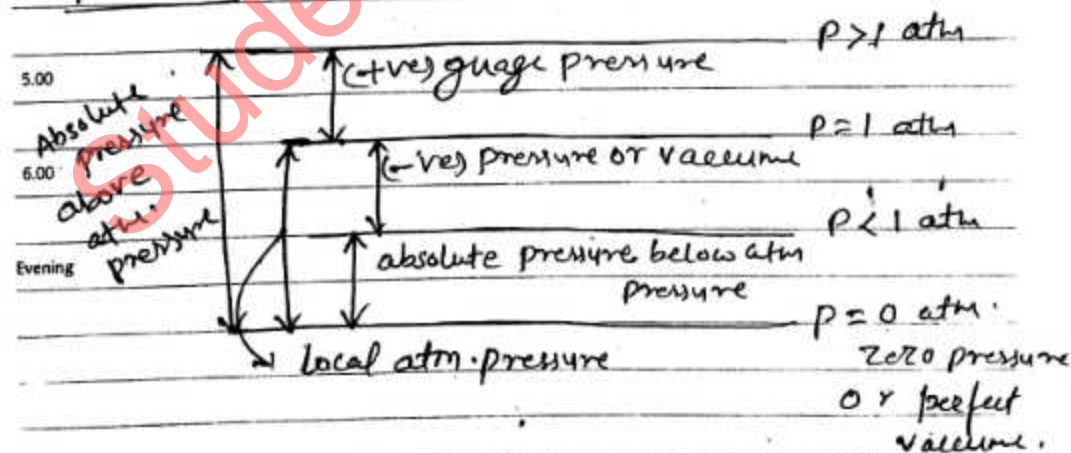
It is slow process. Quasi-static process is equilibrium hence it can say that it is succession of equilibrium state infinite slowness is the characteristic of Quasi-static process. It is also called reversible process.

pure substance :- Homogeneous & chemically in magrable substance is termed as pure substance (e.g - Steam, Atmospheric Air).

Two properties Rule :- physical condition of a pure substance can be specified by only two property.

water - 1 atm.
100°C Temp.

pressure :-



स्वयं के प्रति ईमानदार व्यक्ति ही ईश्वर व इसकी रचना के प्रति ईमानदार होगा।

12

Wednesday

2011

JANUARY

Day : 012-353

Wk : 03

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Fri		7	14 21 28
Sat	1	8	15 22 29
Sun	2	9	16 23 30

$$P_{abs} = P_{gauge} + P_{atm}$$

$$P_{abs} = P_{atm} - P_{vacuum}$$

$$P = \rho \cdot gh$$

Where, P = pressure

g = acceleration due to gravity

h = height

ρ = density.

$$\rho = \text{mass per unit volume} = \frac{M}{V}$$

$$= \rho \cdot gh$$

$$= \frac{kg}{m^3} \cdot \frac{m}{s^2} \times m$$

$$= \frac{kg}{ms^2} = \frac{N}{m^2} = \text{pascal (Pa)}$$

$$1 \text{ Pa} = \frac{1N}{m^2}$$

$$1 \text{ bar} = 10^5 \text{ Pa}$$

$$1 \text{ atm} = 1.013 \text{ bar}$$

Love all and hate none.

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2011
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Thursday

13

Wk : 03

Day : 013-352

Specific Volume :-

Specific volume of a gas is the volume of a unit mass of that gas at some stated pressure and temperature. It is expressed as m^3/kg and is denoted by V .

$$V = \frac{V}{m}$$

$$= 760 \text{ mm Hg}$$

$$p = \rho \cdot g \cdot h$$

$$= 13600 \times 9.81 \times 0.760$$

$$= 101.40 \text{ Kpa}$$

Water - 1000 kg (ρ at STP) (Standard Temp pressure)
 $= 25^\circ\text{C}$
 $= 1 \text{ atm}$
 $= 1 \text{ NTP (National Temp, pressure)}$

$$P_{\text{Hg}} = 13600$$

$$P_{\text{air}} = 1.234$$

Numerical :-

Q Convert the following press to Kpa assuming that.

(a) 40 cm Hg Vacuum

(b) 90 cm Vacuum gauge.

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14

Friday

2011

JANUARY

Day : 014-351 Wk : 03

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c) 1.2 m of H₂O gauge.

8.00

find $P_{absolute} = ?$

9.00

Solⁿ →

10.00

a) 40 cm Hg

11.00

$$P_{vacuum} = \rho \cdot g \cdot h$$

$$= 13600 \times 9.81 \times 40 \times 10^{-2}$$

12.00

$$= 53366.4$$

1000

1.00

$$= 53.3664 \text{ KPa.}$$

2.00

$$P_{abs} = P_{atm} - P_{vacuum}$$

$$= 1.013 \times 10^2 - 53.3664$$

3.00

$$= 47.9336$$

$$= 48 \text{ KPa}$$

4.00

(b) 90 cm Vacuum gauge

5.00

$$P_{gauge} = \rho \cdot g \cdot h$$

$$= 13600 \times 9.81 \times 90 \times 10^{-2}$$

6.00

$$= 120074.4 = 120.0744 \text{ KPa.}$$

Evening

$$P_{abs} = P_{gauge} + P_{atm}$$

$$= 120.0744 + 1.013$$

$$= 121.0874$$

Without knowing 'The One' we can not be one.

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JANUARY

Saturday

15

Wk : 03 Day : 015-350

(c) 1.2 m of the gauge

8.00

$$P_{\text{gauge}} = \rho \cdot g \cdot h$$

$$= 1000 \times 9.81 \times 1.2$$

9.00

$$= 11772 \text{ Pa}$$

$$= 11.772 \text{ kPa}$$

10.00

$$P_{\text{atm}} = P_{\text{gauge}} + P_{\text{atm}}$$

11.00

$$= 11.772 + 1.013$$

$$= 12.785$$

12.00

Energy - 1 Nm = 1 joule.

1.00

Capacity of doing work.

2.00

Power \rightarrow Rate of doing work

3.00

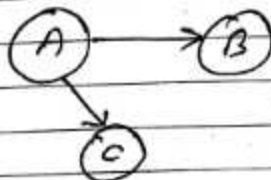
$$\frac{\text{Nm}}{\text{s}} = \frac{\text{J}}{\text{s}} = \text{W (watt)}$$

\hookrightarrow (James Watt)

4.00

5.00 Zeroth Law of Thermodynamic :-

6.00



Evening

Sunday 16

If a body A is in Equilibrium with another body B and body C separately with each other, then body B will be in Thermal Equilibrium with body C.

क्रोध मनुष्य की उन्नति में बाधक है। With body C.

17

Monday

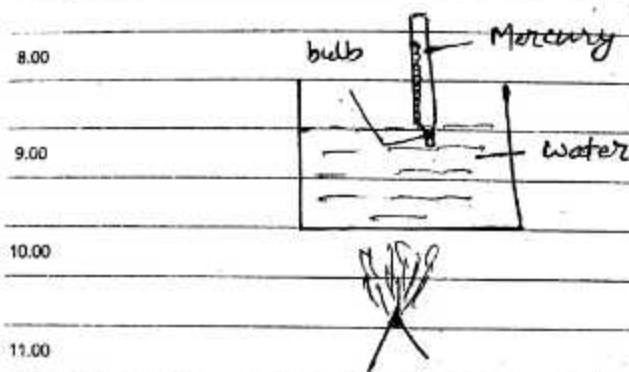
2011

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Day : 017-348

Wk : 04



Temp \rightarrow Kelvin - K
 Degree - $^{\circ}\text{C}$
 Foreigh Height - F
 Renkine - R

Defination :- It is the measure of degree of hotness and coldness.

Triple point of water :- $273.16\text{K} = 0.01^{\circ}\text{C}$

ice point = $273.15\text{K} = 0.00^{\circ}\text{C}$

Work Transfer :- Force \times distance
 $= f \times x$

Evening

Work is set to be done by a system if the shell effect on the think external to the system can be reduced to the raising the weight.

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2011
 JANUARY

Tuesday

18

Wk : 04 Day : 018-347

Sign Convention for Work done (W.D)

8.00

9.00

10.00

11.00

12.00

1.00

2.00

3.00

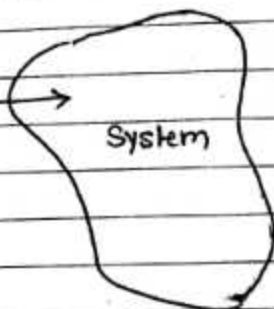
4.00

5.00

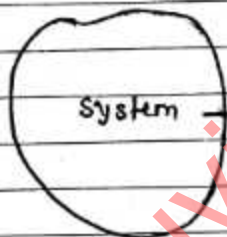
6.00

Evening

Work (-ve)



System $\rightarrow W = (+ve)$

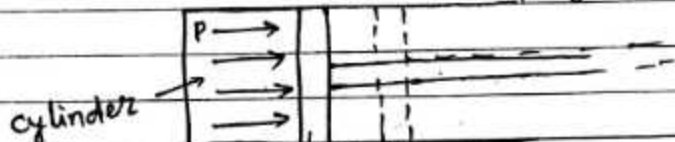


If work added to the system on work is done on the system by the surrounding taken for a (-ve) Negative.

If work is abstracted from the system or work is done by the system on the surrounding then work is taken (+ve) positive.

PDV WORK [Pressure Differential Volume]

$A = \text{Area of cylinder}$



जो दूसरों के दुःख में दूखित हो उसका दुःख दूर करे, वही सन्त होता है।

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P = Pressure

T = Temperature

V = Volume

W = Work

Q = Heat

v = Specific volume

$$W \cdot D = F \times D$$

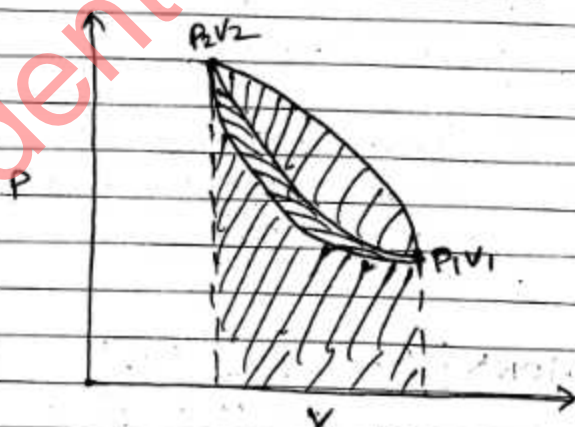
$$= (P \times A) dL$$

$$\Delta W = P \cdot A \times dL$$

$$\int \Delta W = \int_{v_1}^{v_2} P \cdot dv$$

$$W_{1-2} = \int P dv$$

Path function and point function

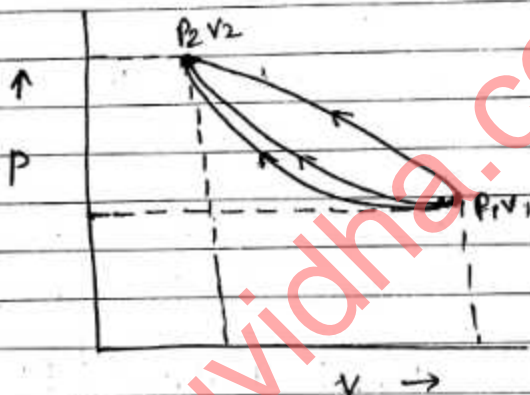


Every quantity as depends upon path
flow known as path function.

Negativity spoils happiness.

e.g - Heat Transfer

These quantities depend upon the state of the function known as point function. and these are the exact differential.



Various process

$$(i) \quad W_{1-2} = \int_{V_1}^{V_2} P \, dV$$

(ii) For Constant pressure ($P=c$).

$$W_{1-2} = P \int_{V_1}^{V_2} dV = P(V_2 - V_1)$$

This process is known as Constant pressure process or Isobaric process.

→ Constant pressure

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Friday

2011

JANUARY

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Day : 021-344

Wk : 04

2) Constant Volume process ($V = C$)

8.00

9.00

$$P \int dv = P \left[v \right]_{v_1}^{v_2} = P[v_2 - v_1]$$

10.00

$$= P[v_1 - v_1] = 0 \text{ (zero)}$$

11.00

But, $v = C$

$$v_1 = v_2$$

12.00

1.00

This process is known as Constant Volume process OR Isochoric OR Isometric

2.00

3) Process Which Follows $[PV = C]$

3.00

$$\therefore PV = P_1 V_1$$

4.00

$$\therefore P = \frac{P_1 V_1}{V}$$

5.00

6.00

$$W_{1-2} = \int_{v_1}^{v_2} P dv = \int_{v_1}^{v_2} \frac{P_1 V_1}{V} dv = P_1 V_1 \ln \frac{v_2}{v_1}$$

Evening

$$W_{1-2} = P_1 V_1 \ln \left(\frac{P_1}{P_2} \right)$$

$$[P_1 V_1 = P_2 V_2]$$

$$\frac{P_1}{P_2} = \frac{V_2}{V_1}$$

Religion unites, never divides

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4) Process Which follows $Pv^n = C$.

$$Pv^n = P_1 v_1^n$$

$$P = \frac{P_1 v_1^n}{v^n}$$

$$W_{1-2} = \int_{v_1}^{v_2} P dv = \int_{v_1}^{v_2} \frac{P_1 v_1^n}{v^n} \cdot dv$$

$$= P_1 v_1^n \int_{v_1}^{v_2} \frac{dv}{v^n}$$

$$= P_1 v_1^n \left[\frac{v^{-n+1}}{-n+1} \right]_{v_1}^{v_2}$$

$$W_{1-2} = \frac{P_1 v_1 - P_2 v_2}{n-1}$$

this process is known as polytropic process.

5) Idealatic process / Iso caloric process ($Q = 0$)

$$[pv^\gamma = C]$$

Sunday 23

$\gamma = \frac{C_p}{C_v}$ = Ratio of Specific heat

C_p = Specific heat at Constant pressure.
 C_v = " " " " " " volume.

न वैर की न तकरार की, आज है ज़रूरत प्यार की।

24 Monday

Day : 024-341 Wk : 05

2011
JANUARY

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8.00

Specific Heat

9.00

Specific heat is amount of heat required to create the 1° different in Temperature up a unit mass.

10.00

11.00

$$Q = MC_p \Delta T$$

12.00

$$C_p = \frac{Q}{M \Delta T} = \frac{\text{KJ}}{\text{kg K}}$$

1.00

Ideabatic Index

2.00

For Air $\gamma = 1.4$

3.00

$$C_p = 1.007 \text{ KJ/kg K}$$

$$C_v = 0.719 \text{ KJ/kg K}$$

4.00

$$C_p - C_v = (R) \rightarrow \text{characteristic gas constant}$$

5.00

6.00

$$R = \frac{R_u}{M}$$

mass

when $R_u = \text{Universal Constant}$
 $= 8314.3 \text{ J/kg mol/K}$

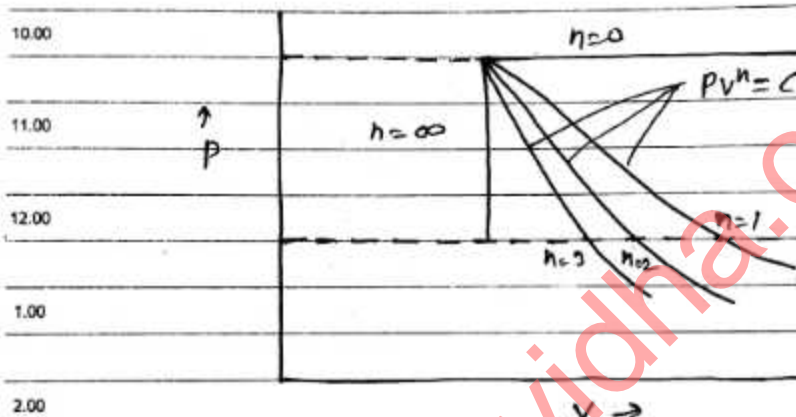
Evening

Evening

For Constant Volume $n = \infty$ pressure $n = 0$ Temp. $n = 1$ Adiabatic $n = \gamma$

Loving is living, if you cease to love, you cease to live.

polytropic $n = n$ [Polytropic index lies b/w Adiabatic & Constant Temperature process.]



n lies b/w 1 and 1.4

Formulae

Indicator Diagram

The indicator diagram is used to determine the Work Done in 1 Newton cycle.

$$P_m = \frac{a_d}{l_d} \times K$$

P_m = Mean effective pressure.

तीन चीजों को कभी छोटा मत समझो - शत्रु, कर्ज, बीमारी।

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Wednesday

2011

JANUARY

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Day : 026-339

Wk : 05

A_d = Area of Indicator diagram.

k = Spring Constant.

l_d = length of Arm of diagram.

$$W.D = P_m A L$$

$$A = \frac{\pi D^2}{4} = \text{Cylinder Area}$$

D = Dia of cylinder or Base.

L = Length of cylinder or stroke.



$$B.P = \text{Brake Power} = \frac{T \omega}{60} = \frac{2\pi N T}{60}$$

T = Torque

ω = Angular Velocity

N = r.p.m

$I.P$ = Indicated Power

$$= \frac{P_m L A N' n}{60}$$

To be religious means to be united with truth.

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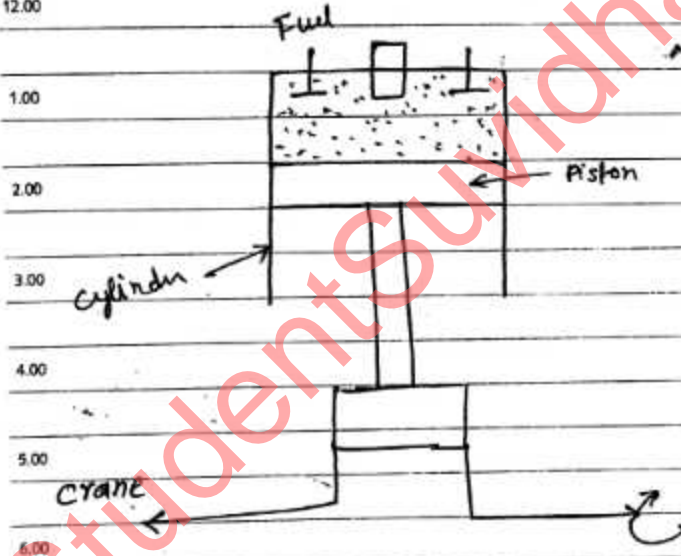
$$N' = N \text{ (for two stroke Engine)}$$

$$N' = \frac{N}{2} \text{ (for 4 stroke Engine)}$$

$$n = \text{No. of cylinder}$$

$$\eta_{\text{mech.}} = \text{efficiency} = \frac{B.P}{I.P} \quad [B.P < I.P]$$

$$I.P - B.P = F.P \text{ (Friction Power)}$$



28

Friday

2011

JANUARY

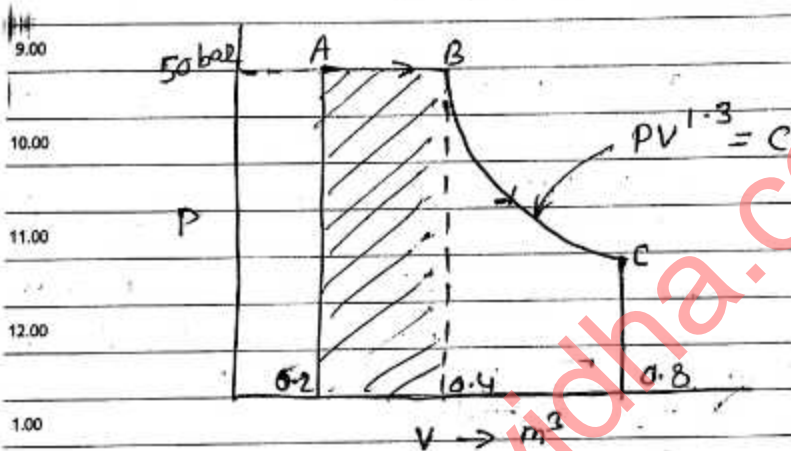
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54/04

Wk : 05

Thermodynamics

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8.00 Numerical

$$P_1 V_1^n = P_2 V_2^n \Rightarrow P_2 = \frac{P_1 V_1^n}{V_2^n}$$

$$P V^n = C \quad \text{--- (i)}$$

$$P V^{1.3} = C \quad \text{--- (ii)}$$

$$W_{A-B} = 50 \times 10^2 (0.4 - 0.2)$$

$$= 50 \times 10^2 \times 0.2$$

$$= 1000 \text{ KJ}$$

$$W_{B-C} = \frac{P_1 V_1 - P_2 V_2}{\gamma - 1}$$

Blessed are those who serve in a spirit of humility and selflessness.

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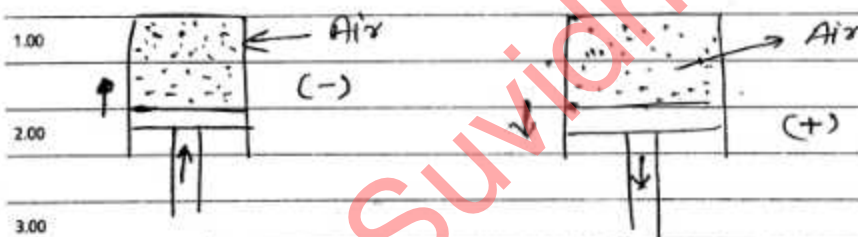
$$8.00 \quad = \frac{50 \times 0.4 - 20.3 \times 0.8}{3} \times 10^2$$

$$9.00 \quad = \frac{(20 - 16.24) 10^2}{3}$$

$$10.00 \quad = \frac{3.76}{3} \times 10^2 = 125.33$$

$$11.00 \quad W_{A-C} = 1253 + 1000 = 2253 \text{ KJ}$$

$$12.00 \quad = 2.253 \text{ MJ}$$



4.00 First Law of Thermodynamics

$$5.00 \quad \oint \delta Q = \oint \delta W$$

6.00 where, \oint = change in work done.

Evening \Rightarrow If it is a system under goes ^{Sunday 30} cyclic chain then the algebraic sum of work done delivered to the surrounding by the system is proportional to the algebraic sum of the heat transfer from the surrounding.

मन जीते जग जीत।

31

Monday

Day : 031-334

Wk : 06

2011

JANUARY

January		2011			
Mon	31	3	10	17	24
Tue		4	11	18	25
Wed		5	12	19	26
Thu		6	13	20	27
Fri		7	14	21	28
Sat	1	8	15	22	29
Sun	2	9	16	23	30

$$\oint \delta Q \propto \oint \delta W$$

$$\oint \delta = \oint \delta W$$

$$\rightarrow S.I = 1 \Rightarrow \frac{Nm}{J}$$

11.00

\Rightarrow First law for a closed system under going a change of state.

1.00

2.00

3.00

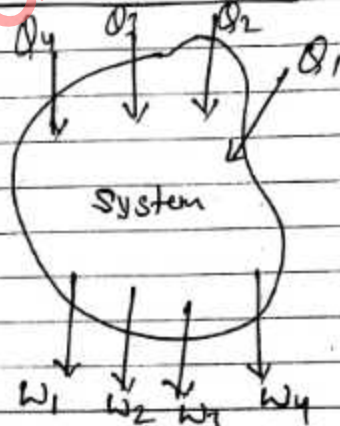
4.00

5.00

6.00

Evening

$$\oint \delta = \Delta E + W$$



We can not direct the wind but we can adjust the sails.

$$\Delta Q = \Delta E + \Delta W$$

8.00

$$Q_1 + Q_2 + Q_3 + Q_4 = \Delta E + W_1 + W_2 + W_3 + W_4$$

9.00

Property \rightarrow Point function.

10.00

Specific Heat & Constant volume

11.00

12.00

\Rightarrow The specific heat of a substance at constant volume C_v is defined as rate of change of internal energy with respect to temperature, when volume is held constant.

2.00

$$C_v = \left(\frac{\partial u}{\partial T} \right)_v$$

3.00

4.00

$$\Rightarrow C_v dT = (\partial u)_v$$

5.00

$$\Rightarrow C_v \int dT = (\Delta u)_v$$

6.00

Evening

Heat Capacity :- $m \times C_v$

\Rightarrow Amount of heat that can absorb

Enthalpy :- Sum of internal energy and flow work.

मनुष्य का अहंकार जितना बड़ा होता है, वह उतना ही छोटा होता है।

02

Wednesday

2011

FEBRUARY

February		2011	
Mon	7	14	21 28
Tue	1	8	15 22
Wed	2	9	16 23
Thu	3	10	17 24
Fri	4	11	18 25
Sat	5	12	19 26
Sun	6	13	20 27

Day : 033-332 Wk : 06

8.00 H. $H = U + PV$

9.00 $h = u + Pv$

10.00 $dh = d(u + Pv)$

$dh = du + Pdv + vdp$ (Pressure
Constant, $d=0$)

12.00 $dh = du + Pdv = (dQ)_P$

1.00 (Enthalpy is heat constant.)

2.00 \Rightarrow Non-Flow process Work

$W(\text{Non-Flow}) = \int Pdv$

3.00

$W(\text{Flow process}) = - \int vdp$

4.00

Specific Heat at Constant process (C_p)

5.00

$C_p = \left(\frac{\partial h}{\partial T} \right)_P$

6.00

Evening \Rightarrow Calculations of γ (γ)

$\gamma = \frac{n+2}{n}$

$n = \text{No. of degree of freedom.}$

It is disgraceful to stumble twice against the same stone.

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Types of Gases

1. $n_{\text{neatomic}} = 5$

2. $n_{\text{polytomic}} = 6$

3. $n_{\text{monoatomic}} = 3$

→ Air is a diatomic gas

PMMI (Perpetual Motions of Machine) of
 find Work.

⇒ It is for first law of Energy. The
 First law states that the general principle
 of Conservation of Energy.

⇒ Energy is neither created nor destroyed.
 It can get only transform from one form to
 another.

⇒ There can be no machine which supply
 mechanical work without Any form of Energy
 disattaining simultaneously. (Such as friction
 machine called PMMI).

04

Friday

2011

FEBRUARY

February 2011					
Mon	7	14	21	28	
Tue	1	8	15	22	
Wed	2	9	16	23	
Thu	3	10	17	24	
Fri	4	11	18	25	
Sat	5	12	19	26	
Sun	6	13	20	27	

Day : 035-330

Wk : 06

Numerical

8.00

Q The properties of certain fluid is related as follows.

9.00

$$u = 196 + 0.718t$$

10.00

$$Pv = 0.287(t + 273)$$

u is dp Internal Energy KJ/kg.

11.00

t is in $^{\circ}\text{C}$

P is in $\frac{\text{KN}}{\text{m}^2}$

12.00

v is specific volume = $\frac{\text{m}^3}{\text{kg}}$

1.00

find c_p and c_p .

2.00

$$\text{Sol}^n \rightarrow \frac{du}{dt} = \frac{d(196 + 0.718t)}{dt} = 0.718$$

3.00

4.00

$$c_v = \left(\frac{\partial u}{\partial T} \right)_v$$

5.00

6.00

$$= \frac{\partial}{\partial t} (196 + 0.718t)$$

Evening

$$= 0.718 \frac{\text{KJ}}{\text{kg}^{\circ}\text{C}}$$

If we demolish man-made walls and barriers, the world would become a better place to live in.

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March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

Saturday

05

Wk : 06

Day : 036-329

$$C_p = \left(\frac{\partial u}{\partial T} \right)_p$$

$$= \left(\frac{\partial (u + p v)}{\partial T} \right)_p$$

$$= \frac{\partial u}{\partial T} + \frac{\partial p v}{\partial T}$$

$$= 0.718 + \frac{\partial}{\partial T} [0.287 (t + 273)]$$

$$= 0.718 + 0.287$$

$$= 1.005 \text{ KJ}$$

KJ°C

$$R = C_p - C_v$$

$$= 1.005 - 0.718$$

$$= 0.287$$

$$R = \frac{R_u}{M}$$

$$M = \frac{R_u}{R} = \frac{8.314}{0.287} = 28.97$$

$$\gamma = 1.4$$

Sunday 6

07

Monday

2011

FEBRUARY

February		2011			
Mon	7	14	21	28	
Tue	1	8	15	22	
Wed	2	9	16	23	
Thu	3	10	17	24	
Fri	4	11	18	25	
Sat	5	12	19	26	
Sun	6	13	20	27	

Day : 038-327 Wk : 07

8.00 Q A mass of 8 kg gas expands within a flexible container with law $PV^{1.2} = C$.
 9.00 Internal pressure = 1000 kPa, initial volume = 1 m^3 .
 Final pressure = 5 kPa. If SP Internal Energy decreases by 40 kJ/kg, find heat transfer
 10.00 magnitude.

11.00

Solⁿ →

12.00

$$P_1 = 1 \times 10^3 \text{ kPa}$$

$$P_2 = 5 \text{ kPa}$$

$$V_1 = 1 \text{ m}^3$$

1.00

$$\eta = 1.2$$

2.00

$$\Delta u = 40 \text{ kJ/kg} (\downarrow)$$

$$m = 8 \text{ kg}$$

3.00

$$V_2 = ?$$

4.00

$$\therefore P_1 V_1^\eta = P_2 V_2^\eta$$

5.00

$$\frac{P_1}{P_2} = \left(\frac{V_2}{V_1} \right)^\eta$$

6.00

$$\sqrt[\eta]{\frac{P_1}{P_2}} = \left(\frac{V_2}{V_1} \right)$$

Evening

$$V_2 = V_1 \times \sqrt[\eta]{\frac{P_1}{P_2}}$$

Belief can flicker but faith is firm.

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March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

Tuesday

08

Wk : 07 Day : 039-326

8.00

$$= 1 \times 1.2 \sqrt{\frac{1 \times 10^3}{5}} = 82.7 \text{ m}^3$$

9.00

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

10.00

11.00

$$= \frac{1000 \times 1 - 5 \times 82.7}{1.9 - 1}$$

12.00

1.00

$$= \frac{1000 - 413.5}{0.2}$$

2.00

3.00

$$= 2932.5$$

4.00

$$Q = \Delta U + W$$

$$= -8 \times 40 + 2932.5$$

5.00

$$= -320 + 2932.5$$

$$= 2612.5$$

6.00

$$Q = +2612.5 \text{ kJ (absorb in the system).}$$

Evening

09

Wednesday

2011

FEBRUARY

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 040-325 Wk : 07

Summary

8.00

$$1. W = \int_1^2 P dv$$

9.00

10.00

$$2. PV^n = C$$

11.00

$$3. C_p = \left(\frac{\partial u}{\partial T} \right)_p$$

12.00

$$4. C_v = \left(\frac{\partial u}{\partial T} \right)_v$$

1.00

2.00

$$5. Q = \Delta u + W$$

3.00

$$6. \oint \delta Q = \oint \delta W$$

4.00

$$7. C_p - C_v = R$$

5.00

$$8. \frac{C_p}{C_v} = \gamma \text{ (gamma)}$$

6.00

$$9. R = \frac{R_u}{M}$$

Evening

where, R_u = universal gas constant
 M = Molecular wt.

$$10. h = u + Pv$$

This world is too small for walls.

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March					2011
Mon	7	14	21	28	
Tue	1	8	15	22	29
Wed	2	9	16	23	30
Thu	3	10	17	24	31
Fri	4	11	18	25	
Sat	5	12	19	26	
Sun	6	13	20	27	

2011
FEBRUARY

Thursday

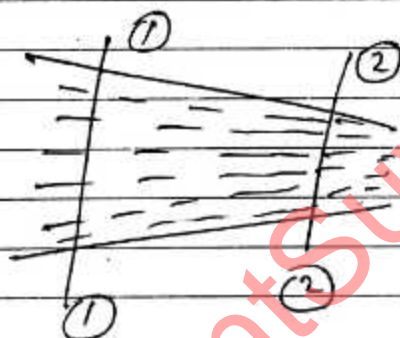
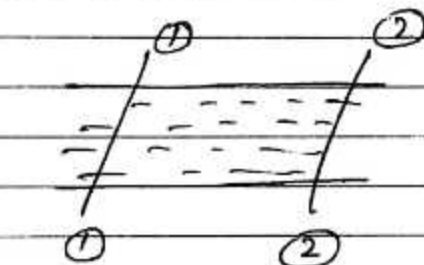
10

Wk : 07

Day : 041-324

First Law applied to Flow process

SFEE - Steady Flow Energy Equation.



11

Friday

2011

FEBRUARY

Mon	7	14	21	28
Tue	1	8	15	22
Wed	2	9	16	23
Thu	3	10	17	24
Fri	4	11	18	25
Sat	5	12	19	26
Sun	6	13	20	27

Day : 042-323

Wk : 07

8.00

9.00

10.00

11.00

12.00

1.00

2.00

3.00

4.00

5.00

6.00

Evening

Why use harsh words when the sweet ones serve the purpose.

March 4 2011
 Mon 7 14 21 28
 Tue 1 8 15 22 29
 Wed 2 9 16 23 30
 Thu 3 10 17 24 31
 Fri 4 11 18 25
 Sat 5 12 19 26
 Sun 6 13 20 27

2011
 FEBRUARY

Saturday

12

Wk : 07 Day : 043-322

properties of Gases

If the working fluid condense during thermodynamic process. It is called vapour. many gases which do not change shear force cleaning the Thermodynamic process and changes the Common Rule. Governing change. These properties are called ideal perfect gas.

Boyle's Law

$$V \propto \left(\frac{1}{P}\right)_{T=C}$$

$$V = \left(\frac{C}{P}\right)_{T=C}$$

$$\text{or } PV = C$$

$$P_1 V_1 = P_2 V_2 = C \text{ @ } T = \text{Constant.}$$

Charles's Law

$$\textcircled{1} V \propto (T)_{P=C}$$

$$\frac{V}{T} = \text{Constant}$$

आशा, विश्वास, प्रेम में से सबसे बड़ा प्रेम है।

14 Monday

Day: 045-320 Wk: 08

2011 FEBRUARY

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

8.00 $\frac{V_1}{T_1} = \frac{V_2}{T_2} = C @ P = C$

9.00 (ii) $P \propto (T)_V = C$

10.00 $\frac{P_2}{P_1} = \frac{T_2}{T_1} @ V = C$

11.00

$$PV = RT$$

12.00

$$PV = nRT$$

1.00 For Ideal gases

2.00 $\left(\frac{T_2}{T_1}\right) = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

3.00 $\left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \frac{T_2}{T_1}$

4.00

5.00 $C_n = C_v \left(\frac{\gamma - n}{1 - n} \right)$

6.00

Evening $Q = nC_p \Delta T$

$$Q = nC_v \Delta T$$

$$Q_p = nC_n \Delta T$$

We can remember God even while performing our worldly duties sincerely.

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March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

Tuesday

15

Wk : 08 Day : 046-319

Second Law of thermodynamic

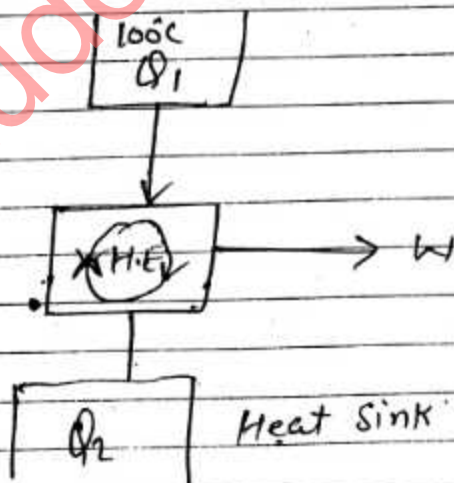
Kelvin plank statement

It is impossible for heat Engine to produce net work a complete cycle. It heat changes Only Heat body at a single fixed Temp.

Clausius statement :-

It is the impossible to Constant to device which Operating a cycle will produce No. effect other than the Transfer of heat from cooler to hotter body.

Heat Engine (Cycle) :-



16

Wednesday

2011
FEBRUARY

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 047-318

Wk : 08

$$Q_1 = W + Q_2$$

8.00

$$Q_1 - Q_2 = W$$

9.00

$$\eta = \frac{W}{Q_1} = \frac{Q_1 - Q_2}{Q_1} = 1 - \frac{Q_2}{Q_1}$$

10.00

11.00

12.00

$$\therefore \eta_{HE} = 1 - \frac{Q_2}{Q_1}$$

(HE = Heat Engine)

1.00

2.00

Energy Reservoir :-

3.00

TER (Thermal Energy Reservoir)

4.00

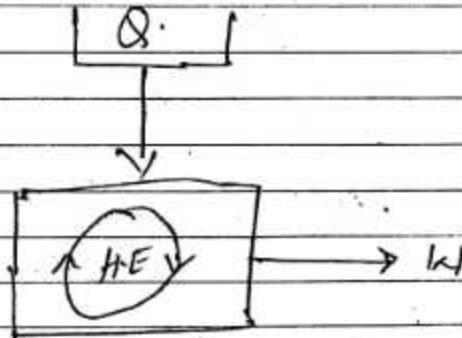
Heat producing (TER) → Heat source

Heat absorbing (TEA) → Heat sink.

5.00

6.00

Evening

PMM-2PMM-II

Trust in God bestows peace of mind.

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March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

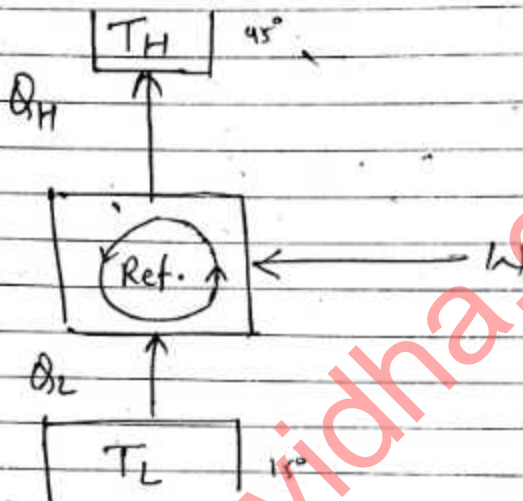
Thursday

17

Wk: 08

Day: 048-317

Heat Pump :- (Refrigerator)



$$W = Q_L - Q_H$$

$$(COP)_R = \eta = \frac{Q_L}{W} = \frac{Q_L}{Q_H - Q_L} = \frac{T_L}{T_H - T_L}$$

$$(\text{Coefficient of performance})(COP) = \frac{Q_L}{Q_H - Q_L}$$

$$(COP)_{HP} = \frac{Q_H}{Q_H - Q_L} = \frac{T_H}{T_H - T_L}$$

(HP = Heat Pump)

$$(COP)_{HP} = (COP)_R + 1$$

यह एक ठंडे ठंडे की भांति होता है और यही ठंडे की महक है।

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18

Friday

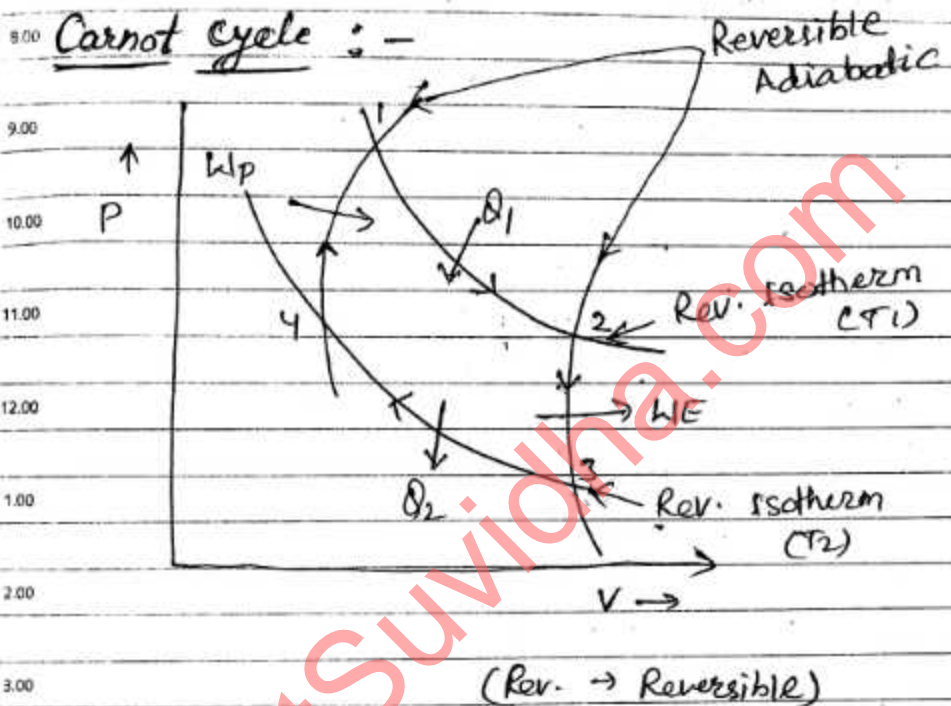
2011

FEBRUARY

February	2011
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 049-316

Wk : 08



Egn of IInd Thermodynamic Say that
 No more then efficiency of Carnot
 cycle. All the Reversible Engine Same
 Efficiency.

Absolute Temperature Scale

$$\frac{Q_1}{T_1} = \frac{Q_2}{T_2} = \frac{Q_3}{T_3}$$

Truth is higher than everything, but higher still is truthful living.

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$$\frac{Q_1}{Q_2} = \frac{T_1}{T_2}$$

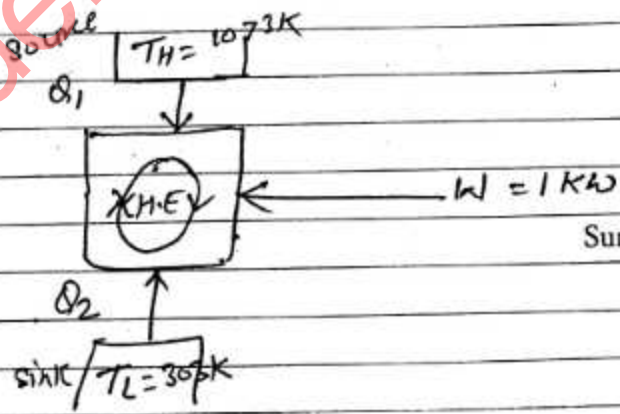
$$\Rightarrow 1 - \frac{Q_2}{Q_1} = 1 - \frac{T_2}{T_1}$$

Free Expansion process is Reversible process.

Numerical

Q A cycle heat Engine B/w a Source Temp. of 800°C and a Sink Temp. 30°C . What is least Rate of heat rejection per Kw. net o/p of Engine.

Solⁿ $T_H = 800^\circ\text{C} = 800 + 273 = 1073\text{K}$
 $T_L = 30^\circ\text{C} = 30 + 273 = 303\text{K}$



जब मन निर्मल हो गया तो जीवन भी निर्मल हो जायेगा।

21

Monday

2011
FEBRUARY

Day : 052-313

Wk : 09

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

$$\eta = \frac{1 - T_L}{1 - T_H} = \frac{1 - 303}{1073}$$

9.00

$$= \frac{1073 - 303}{1073} = \frac{770}{1073}$$

10.00

$$= 0.718$$

11.00

$$= 71\%$$

12.00

$$\therefore \eta = \frac{W}{Q_1}$$

1.00

$$\Rightarrow Q_1 = \frac{W}{\eta} = \frac{1}{0.718} = 1.3927 \text{ kW}$$

3.00

$$\therefore Q_1 - Q_2 = W$$

4.00

$$\Rightarrow 1.3927 - Q_2 = 1 \text{ kW}$$

5.00

$$\Rightarrow 1.3927 - 1 = Q_2$$

6.00

$$\therefore Q_2 = 0.3927 \text{ kW} \quad \Delta$$

Evening

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

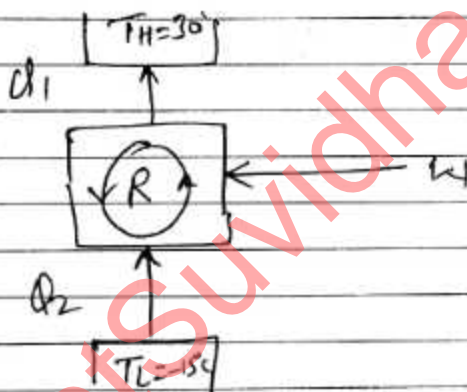
Tuesday

22

Wk : 09 Day : 053-312

Q A domestic Refrigerator maintains a Temp. of -15°C . The ambient air Temp. is 30°C . It heat leaks at a Continuous Rate of 1.75 KJ/s . What is the least power necessary to pump this heat out continuously.

$$\begin{aligned} T_H &= 30^{\circ}\text{C} = 30 + 273 = 303 \text{ K} \\ T_L &= -15^{\circ}\text{C} = -15 + 273 = 258 \text{ K} \end{aligned}$$



$$\therefore \frac{Q_L}{T_L} = \frac{Q_H}{T_H}$$

$$\Rightarrow \frac{1.75}{258} = \frac{Q_H}{303}$$

$$\Rightarrow Q_H = \frac{1.75 \times 303}{258}$$

$$\therefore Q_H = 2.055 \text{ KJ/s}$$

हमेशा विनम्रता, प्यार, करुणा और दया के भाव से युक्त रहना चाहिए।

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23

Wednesday

2011

FEBRUARY

Day: 054-311

Wk: 09

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

$$\Rightarrow Q_H = Q_L + W$$

$$\Rightarrow Q_H - Q_L = W$$

$$\Rightarrow 2.055 - 1.75 = W$$

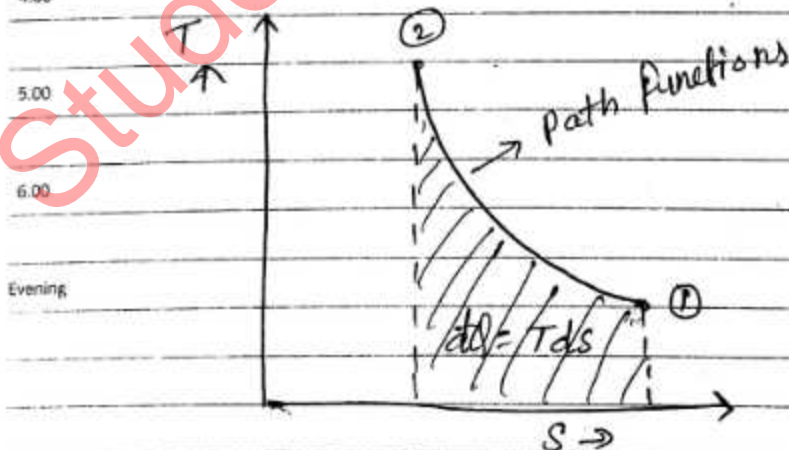
$$\therefore W = 0.305 \text{ KJ. } \checkmark$$

ENTROPY (S)

$$ds = \frac{dQ}{T}$$

$$\Rightarrow dQ = T ds$$

$$\Rightarrow dW = P dv$$



March		2011			
Mon		7	14	21	28
Tue	1	8	15	22	29
Wed	2	9	16	23	30
Thu	3	10	17	24	31
Fri	4	11	18	25	
Sat	5	12	19	26	
Sun	6	13	20	27	

2011
FEBRUARY

Thursday

24

Wk : 09 Day : 055-310

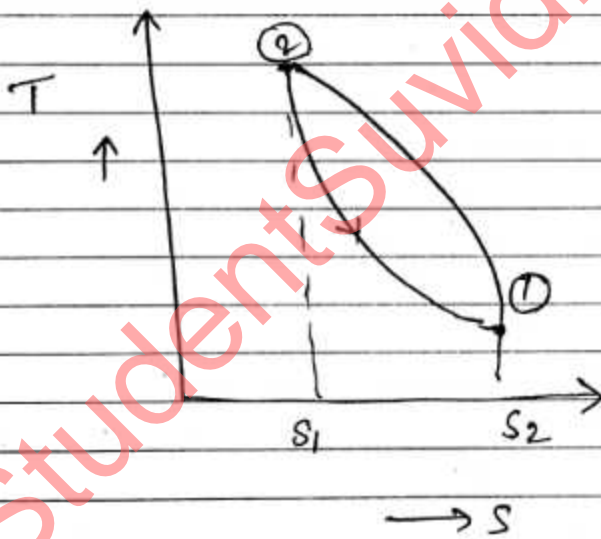
Classious Inequality :-

$$\oint ds = \oint \frac{dQ}{T} \leq 0$$

= 0 Reversible process.

= < 0 Irreversible and possible

> 0 Impossible cycle violating 2nd Law of Thermodynamics.



सत्युरु ने जब विद्यालय के टीचाय कथारे तो जन्मों की मेल दूर हो गयी।

25

Friday

2011

FEBRUARY

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 056-309

Wk : 00

8.00

9.00

10.00

11.00

12.00

1.00

2.00

3.00

4.00

5.00

6.00

Evening

more - Carnot cycle \rightarrow Impossible.
less - Carnot " \rightarrow Reversible.
equal - Carnot " \rightarrow Irreversible.

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

2011
FEBRUARY

Saturday

26

Wk : 09

Day : 057-306

Heat Engine

8.00

9.00

10.00

11.00

12.00

1.00

2.00

3.00

4.00

5.00

6.00

Evening

Internal Combustion
Engine

External Combustion
Engine

Combustion takes place
inside a cycle.

Two stroke
Engine

4 stroke Engine

Petrol Engine
works on otto cycle
(CNG)

Diesel Engine
works on Diesel
cycle.

TWO-STROKE ENGINE (2-stroke Engine) Sunday 27

↓
PTO

गुरसिख, गुरसिख के साथ व्यवहार करते समय मर्यादा का ध्यान रखते हैं।

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28

Monday

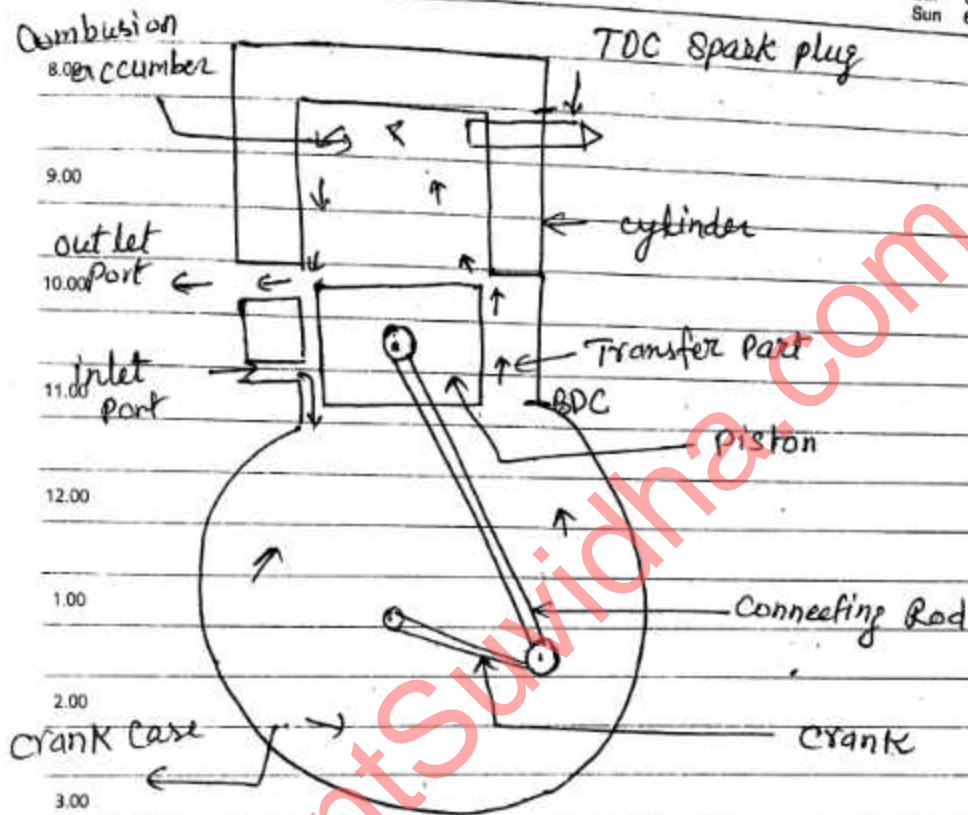
2011

FEBRUARY

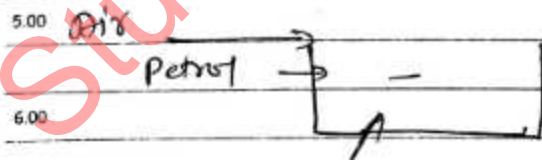
Day : 059-306

Wk : 10

February 2011	
Mon	7 14 21 28
Tue	1 8 15 22
Wed	2 9 16 23
Thu	3 10 17 24
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27



2 S Engine



Air and petrol mixed

Spark Engine → petrol engine
 diesel engine → injector

April	2011
Mon	4 11 18 25
Tue	5 12 19 26
Wed	6 13 20 27
Thu	7 14 21 28
Fri	1 8 15 22 29
Sat	2 9 16 23 30
Sun	3 10 17 24

2011
MARCH

Tuesday

01

Wk : 10 Day : 060-305

① It stores Energy

② It reduces fluctuation.

TDC - max. pt. distance at which piston can reach it.

Two stroke is most powerful engine.

It has four sections

① Compression

② Power

③ Exhaust

It has two strokes and these are Single Combustion of two stroke engine.

① Petrol engine : Compression engine
(7:1) : (11:1)

② Diesel engine - (14:21)

Four - stroke engine

PTO

02

Wednesday

2011

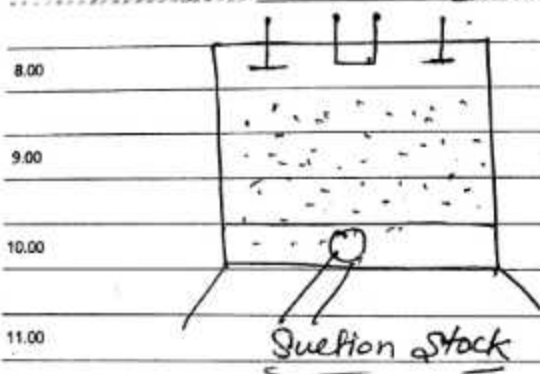
MARCH

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 061-304

inlet valve

exhaust valve



Suction stock :- inlet valve open (IVO) and EVO both value closed.

Exhaust :- EVO (Exhaust value open) and IVC

Size of EV < size of IV

Two Recombusion for one power stock.

TDC to BDC — 180° (two stock)
360° (four - stock)

Petrol Engine : (otto cycle)

Process

A drop of action is better than the ocean of preachings.

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02

Wednesday

2011

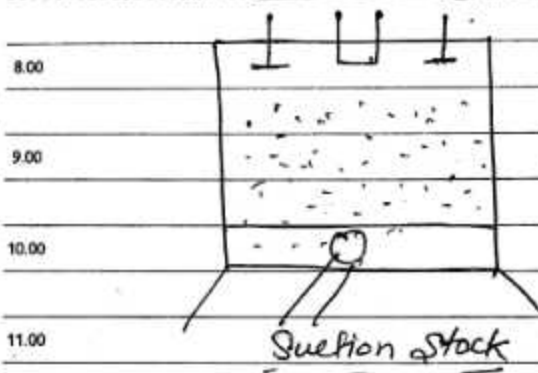
MARCH

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
Sat	5 12 19 26
Sun	6 13 20 27

Day : 061-304

inlet valve

exhaust valve



Suction stock :- inlet valve open (IVO) and EVO both valve closed.

Exhaust :- EVO (Exhaust valve open) and IVC

Size of EV < Size of IV

- Two Recombusion for one power stock.

TDC to BDC - 180° (two stock)

Evening

360° (four-stock)

Petrol Engine : (otto cycle)

process

A drop of action is better than the ocean of preachings.

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April 2011
 Mon 4 11 18 25
 Tue 5 12 19 26
 Wed 6 13 20 27
 Thu 7 14 21 28
 Fri 1 8 15 22 29
 Sat 2 9 16 23 30
 Sun 3 10 17 24

2011
 MARCH

Thursday

03

Wk: 10 Day: 062-303

8.00 # Otto cycle - It has 2 - adiabatic processes & Two constant volume processes.

9.00 # Adiabatic process - Reversible adiabatic process.

11.00 # Heat is added and Rejected and Constant Volume pressure.

12.00 # Compression and Impression are reversible adiabatic process.

2.00 Const. volume + Q
 Const. volume - Q

3.00 Diesel cycle :-

4.00 It has 2 - reversible adiabatic process, 1 is Constant pressure process.

5.00 1 - Constant volume, Heat addition
 6.00 Const. pressure remaining as same process.

Evening Modes of Heat transfer

- ① Conduction
- ② Convection
- ③ Radiation

04

Friday

2011

MARCH

Day : 063-302 Wk : 10

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
Wed	2 9 16 23 30
Thu	3 10 17 24 31
Fri	4 11 18 25
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① Conduction : - Heat transfer due to Molecular Activity.

Heat transfer become of the motion of a fuel part over a heated surface. faster the movement greater then heat transfer

Fourier's Law :-

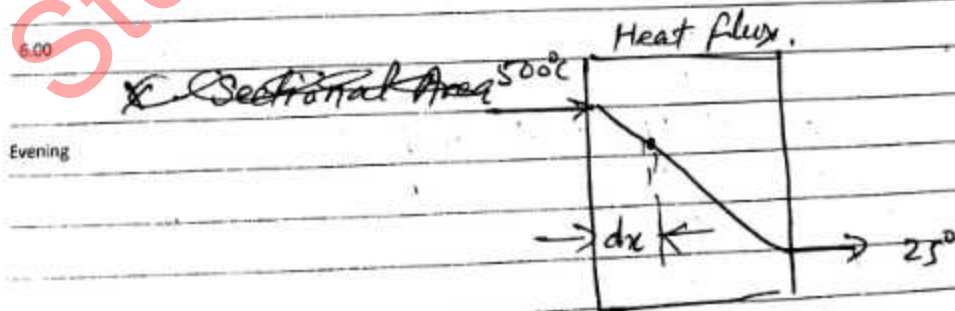
$$q = -K \frac{dT}{dx}$$

where dT = Temp. Differential

K = Coefficient of Thermal Conductivity

dx = length of heat transfer

q = Heat transfer per Unit Area.



Apr	4	11	18	25
Mon	5	12	19	26
Tue	6	13	20	27
Wed	7	14	21	28
Thu	8	15	22	29
Fri	9	16	23	30
Sat	10	17	24	
Sun				

2011
MARCH

Saturday

05

Wk : 10

Day : 064-301

$$Q = -KA \frac{dT}{dx}$$

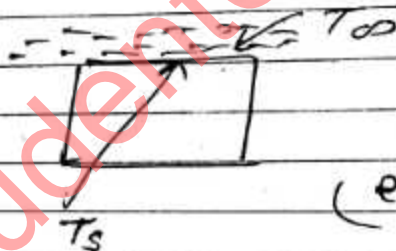
$$K = \frac{W \times m}{m^2 \times K} = \frac{W}{mK} \text{ (unit)}$$

$$q = K \frac{DT}{L}$$

② Convection :-

Newton's law of cooling

$$q = h(T_s - T_\infty)$$



(e.g. → cooler)

where, h = Convection heat transfer coefficient

Sunday 6

T_∞ = Fluid Temp.

T_s = Surface Temp.

q = Heat Flux.

पहले परमात्मा को जानो, जिसकी भक्ति कर रहे हो।

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07

Monday

2011

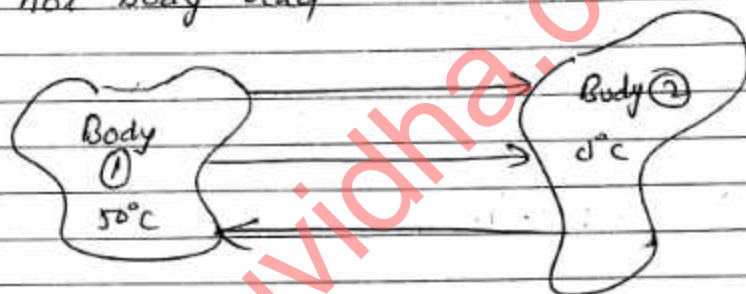
MARCH

March	2011
Mon	7 14 21 28
Tue	1 8 15 22 29
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Thu	3 10 17 24 31
Fri	4 11 18 25
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Sun	6 13 20 27

Day : 066-299

Wk : 11

8.00 ③ Radiation :- All body radiate
 9.00 heat the phenomena is identical to
 initial applied is isolated together
 a vacuum radiate heat to each other.
 10.00 But, the colder body is see more than
 the hot body and



3.00 Stefan Boltzmann Law :-

$$Q = \sigma A T^4$$

4.00
 5.00 where, T = Body Temp (Kelvin)
 A = projected Area
 σ = Stefan-Boltzmann
 Constant

Evening

$$= 5.67 \times 10^{-8} \frac{W}{m^2 K^4}$$

No body can save us if we go on loading the boat of life with ego.

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