Catalog

UNIT - V

Gas Mixtures & Psychrometry

Psychrometry: is the science, which deals with the study of behaviour of Moist air is known as psychrometry.

Properties of psychrometry: properties:

① Dry air: The dry air is nothing but the air without moisture (or) water vapour.

② Moist air: It is the mixture of dry air & water vapour.

③ Moisture: The water vapour present in the air is known as moisture.

④ Dry bulb Temperature (DBT) (t_d)
The Temperature of air measured by an ordinary thermometer is known as DBT.

⑤ Wet Bulb Temperature: (WBT) (t_w)
It is the Temperature of air measured by a thermometer when its bulb is covered with wet cloth.

⑥ Wet bulb depression (WBD)
It is the Difference between DBT & WBT

WBD = DBT − WBT

The value of WBD is zero when the air becomes saturated.

⑦ Dew Point temperature (DPT) (t_{dp}):
It is the Temperature at which the water vapour present in air begins to condense when the air is cooled.

For saturated air DBT = WBT = DPT

⑧ Dew Point Depression: DPD

D.P.D = DBT − DPT

⑨ Sp. humidity (or) humidity Ratio (ω):

$$\omega = \frac{\text{mass of water vapour}}{\text{mass of dry air}} = \frac{m_v}{m_a}$$

$$\omega = 0.622 \frac{P_v}{P_b - P_v}$$

P_v — Partial Pr. of water vapour.
P_b — Barometric pressure.

⑩ Degree of saturation (μ)

$$\mu = \frac{\text{Sp. humidity of Moist air}}{\text{Sp. humidity of Saturated air}}$$

$$\omega = 0.622\,\frac{P_v}{P_b - P_v}$$

$$\omega_s = 0.622\,\frac{P_s}{P_b - P_s}$$

P_s - Saturated P_v (taken from S.T)

⑪ Relative humidity: (R.H) (ϕ)

$$\phi = \frac{\text{mass of water vapour}}{\text{Sat. mass of water vapour}} = \frac{m_v}{m_s}$$

$$\phi = \frac{m_v}{m_s} \quad \text{(or)} \quad \phi = \frac{P_v}{P_s}$$

⑫ Total Enthalpy of moist air (H)

$$H = C_p t_d + \omega h_g$$

C_p - 1.005 kJ/kg K
t_d - dry bulb Temp
ω - Sp. humidity
h_g - Sp. enthalpy of air corresponding to DBT.

Dalton's Law of Partial Pressure:

The total pressure exerted by air and water vapour is equal to the barometric pressure.

$$P_b = P_a + P_v$$

P_b - Barometric Pressure
P_a - Partial P. of dry air
P_v - " " of water vapour.

$$P_v = P_{sw} - \frac{(P_b - P_{sw})(t_d - t_w)}{1527.4 - 1.3\,t_w}$$

P_{sw} - Sat. Pressure corresponding to wet bulb Temp. (S.T)

t_d - DBT in °C
t_w - WBT in °C

Dry bulb and Wet bulb temperature of atmospheric air stream are 40°C and 30°C respectively. Determine (i) Humidity ratio (ii) Relative humidity (iii) Sp. enthalpy.

G.D:

DBT (or) $t_d = 40°C$

WBT (or) $t_w = 30°C$

$P_b = 1$ bar.

To find: (i) ω (ii) ϕ (iii) h

Solution:

(i) Humidity Ratio $\omega = 0.622 \dfrac{P_v}{P_b - P_v}$

$$P_v = P_{sw} - \frac{(P_b - P_{sw})(t_d - t_w)}{1527.4 - 1.3 t_w}$$

$P_{sw} = ?$

From steam Table corresponding to WBT = 30°C

$P_{sw} = 0.04242$ bar

$$P_v = 0.04242 - \frac{(1 - 0.04242)(40 - 30)}{1527.4 - 1.3(30)}$$

$P_v = 0.035986$ bar

$$\omega = 0.622 \frac{P_v}{P_b - P_v} = 0.622 \frac{0.035986}{1 - 0.035986}$$

$\omega = 0.0232$ kg/kg of dry air

(ii) Relative humidity $\phi = \dfrac{P_v}{P_s}$

$P_s = ?$

From steam Table corresponding to DBT 40°C

$P_s = 0.07375$ bar

$$\phi = \frac{0.035986}{0.07375} \times 100 = 0.488 \times 100 = 48.8\%$$

(iii) Enthalpy (h):

$$h = C_p t_d + \omega h_g$$

$h_g = ?$ From steam Table corresponding to DBT 40°C

$h_g = 2574.4$ kJ/kg

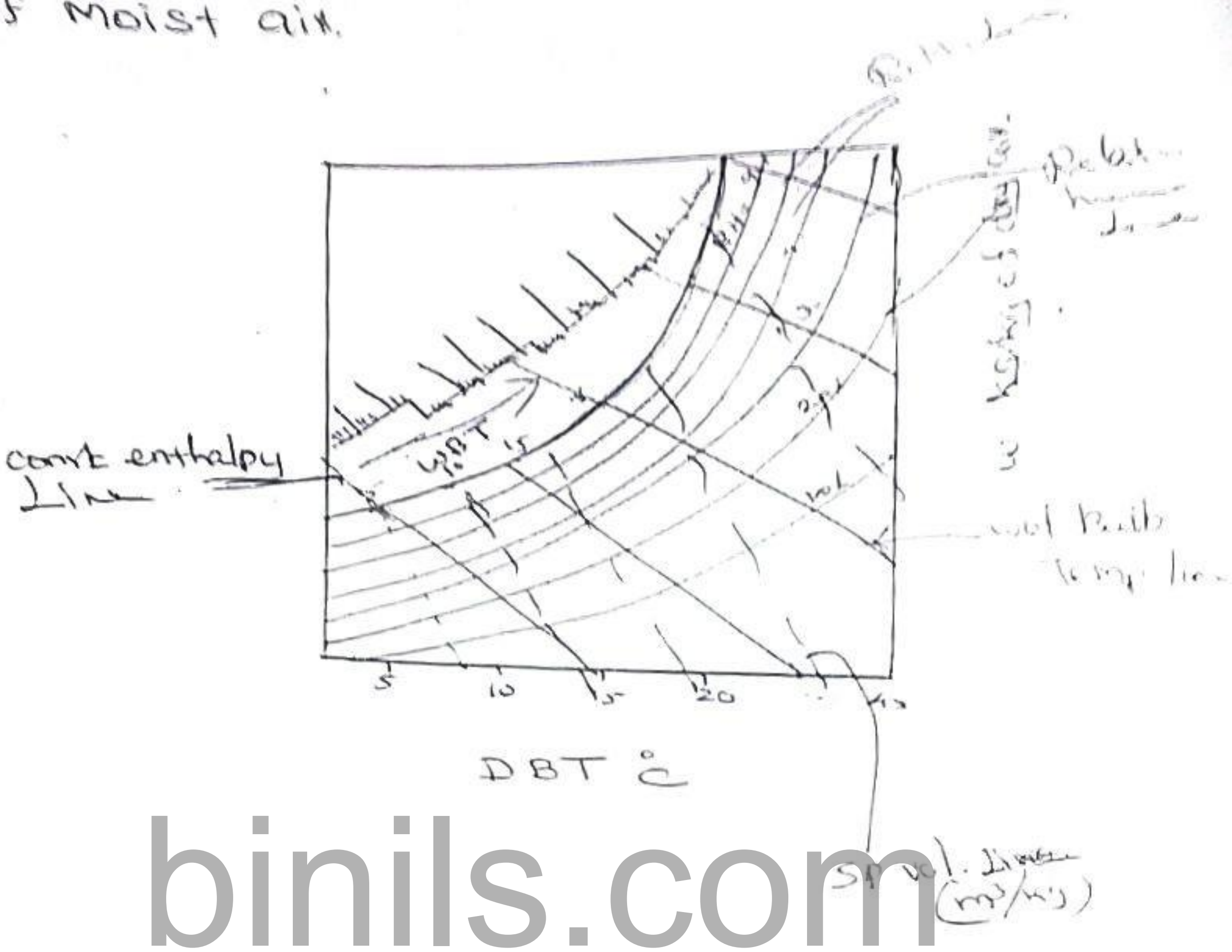
$h = 1.005(40) + 0.0232(2574.4)$

~~$h = 374.29$ kJ/kg~~

$h = 99.29$ kJ/kg

Psychrometry Chart:

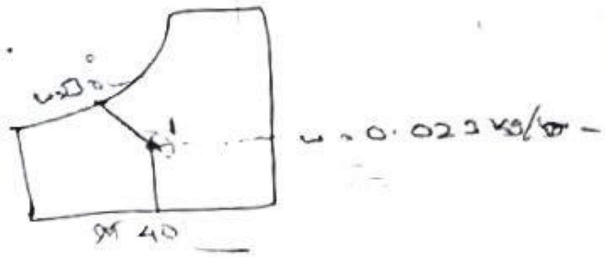
It indicates the various properties of moist air.



Solution:

i) $\omega = ?$ Sp. humidity (ω):

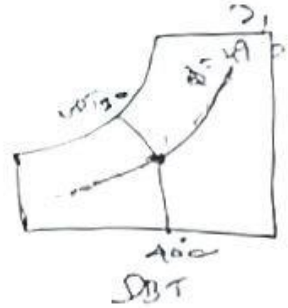
$\omega = 0.027$ kg/kg of dry air.



ii) Relative humidity: ϕ

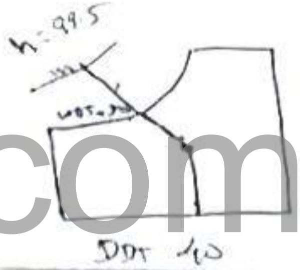
~~From psychrometry~~

$\phi = 49\%$



iii) Specific Enthalpy:

$h = 99.5$ KJ/kg



2. A sling psychrometer reads 40°C DBT and 36°C WBT. Find the humidity Ratio, Relative humidity, dew point Temp, sp volume of air, density of air, ~~density of water vapour~~ and enthalpy.

GD:

DBT = 40°C

WBT = 36°C.

To find: ω, ϕ, DPT, v_a, ρ_a, ρ_v, h

Solution:

(i) $\omega = ?$ humidity Ratio $\omega = ?$

$$\omega = 0.622 \frac{P_v}{P_b - P_v}$$

$$P_v = P_{sw} - \frac{(P_b - P_{sw})(t_d - t_w)}{1527.4 - 1.3\, t_w}$$

$P_{sw} = ?$ Sat. Pr corresponding to WBT.
From. steam Table at WBT = 36°C

$P_{sw} = 0.05940$ bar

$$P_v = 0.05940 - \frac{(1 - 0.05940)(40-36)}{1527.4 - 1.3(36)}$$

$$P_v = 0.05940 - 0.00254$$

$$\boxed{P_v = 0.05686 \text{ bar}}$$

$$\omega = 0.622 \times \frac{0.05686}{1 - 0.05686}$$

$$\boxed{\omega = 0.037 \text{ kg/kg of dry air.}}$$

(ii) Relative humidity : ϕ :

$$\phi = \frac{P_v}{P_s}$$

$P_s \Rightarrow$ saturated Pr. corresponding to DBT.

From S.T at 40°C

$$P_s = 0.07375 \text{ bar.}$$

$$\phi = \frac{0.05686}{0.07375} = 0.77 \times 100$$

$$\boxed{\phi = 77\,\%}$$

(iii) Dew point temp. : DPT.

It is the temp. correspond to "P_v" value

From S.T at $P_v = 0.05686$ bar.

$$\boxed{DPT = 35°C}$$

(iv) Sp. volume of air : V_a.

From Gas Law

$$P_a V_a = R T_a.$$

$$V_a = \frac{R T_a}{P_a}$$

$R = 0.287$ kJ/kgK.

$T_a = 40 + 273 = 313$ K

$P_a = ?$

$P_b = P_a + P_v$

$P_a = P_b - P_v$

$= 1 - 0.05686$

$P_a = 0.94314$ bar $\times 10^5$ N/m²

$P_a = 94.314$ kN/m²

$$V_a = \frac{0.287 \times 313}{94.314}$$

$$\boxed{V_a = 0.95 \text{ m}^3/\text{kg}}$$

) Density of air : $\rho_a = \frac{1}{V_a} = \frac{1}{0.95}$

$$\rho_a = 1.05 \ Kg/m^3$$

vi) Enthalpy (h) :

$h = C_p t_d + \omega h_g$

$C_p = 1.005$ KJ/Kg*
$t_d = 40°C$
$\omega = 0.037$ Kg/kg of dry air

$h_g \Rightarrow$ enthalpy of air Corresponding to DBT

From S.T at 40°C.

$h_g = 2574.4$ KJ/Kg.

$h = 1.005 \times 40 + 0.037 (2574.4)$

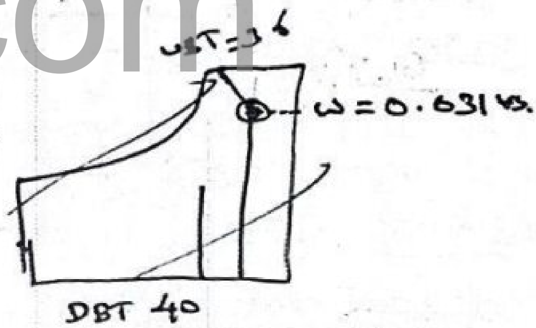
$= 40.2 + 95.2528$

$$h = 135.45 \ KJ/kg$$

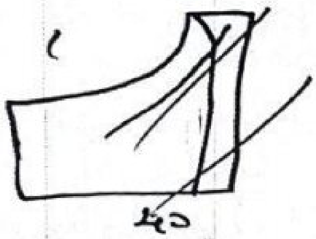
Psychrometry Chart

(i) humidity Ratio ω:

$\omega = 0.031$ Kg/Kg of dry air.

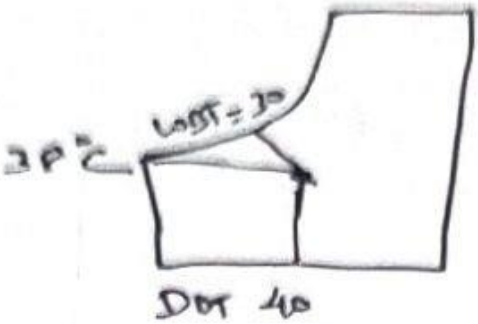


(ii) Relative humidity ϕ:



(iv) DPT = ?

DPT = 27.5°C



(v) Sp volume:

$v = 0.92\ m^3/kg$

(vi) $P_v = 3.5$ ~~bar~~ kPa

$= \frac{3.5\ kN/m^2}{10^2}$

$1\ bar = 10^5\ N/m^2$

$= 0.035$ bar

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3. Atmospheric air at 1 bar pressure has 25°C dry bulb temperature and 75% Relative humidity. Using Psychrometry Chart, Calculate DPT and h & vapour pressure.

G.D: $p = 1$ bar

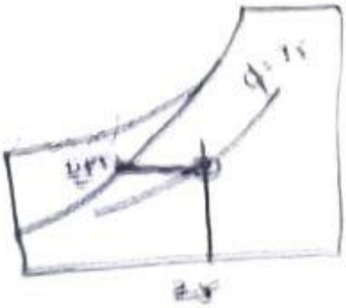
DBT = 25°C

$\phi = 75\%$

To find: DPT, h, P_v

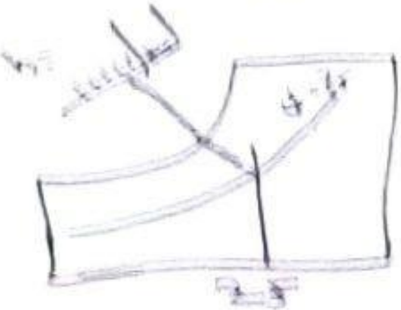
(i) Dew point Temp. DPT.

DPT = 20°C



(ii) Enthalpy 'h'.

h = 63 kJ/kg



(iii) Vapour pressure P_v

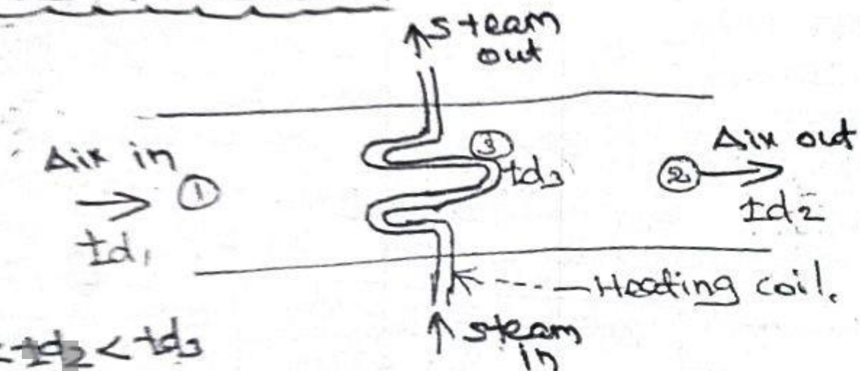
P_v = [illegible] kPa

Psychrometry processes:

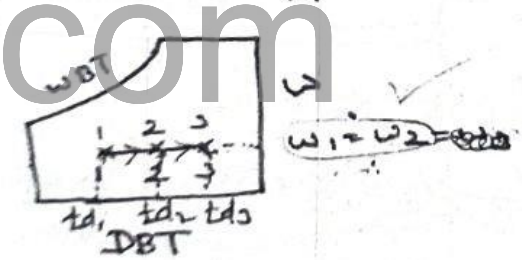
1. Sensible heating process.
2. Sensible Cooling Process
3. Humidification Process
4. De Humidification process.
5. Heating and Humidification process
6. Cooling and De-Humidification process.
7. Adiabatic mixing process.
8. Evaporative Cooling process.

adi. sat. proc.

1. Sensible Heating process:



$td_1 < td_2 < td_3$



In sensible heating process cold air passes through the heating coil and it absorb the heat from the steam and converted it into hot air.

During this process DBT increases from td_1 to td_2. But, there is no addition of moisture in the air. So, $\omega_1 = \omega_2$

The efficiency of heating coil is measured interms of By pass factor.

BPF is defined as the portion of air that passes through the coil without contacting the coil surface.

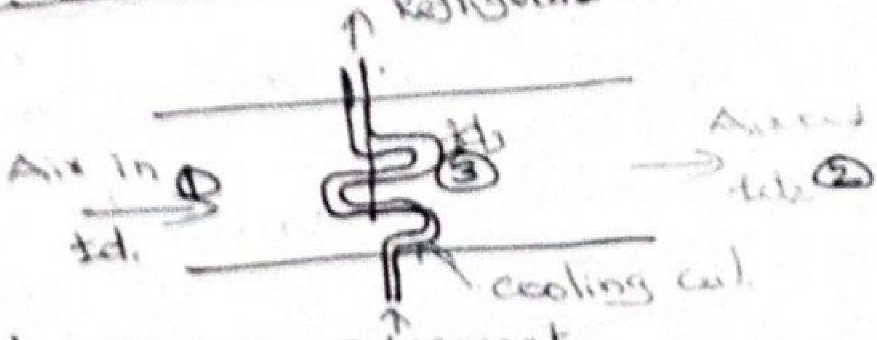
$Q = m C_p \Delta T$

$$B.P.F = \frac{td_3 - td_2}{td_3 - td_1}$$

Heat absorbed by air $Q = m_a (h_2 - h_1)$

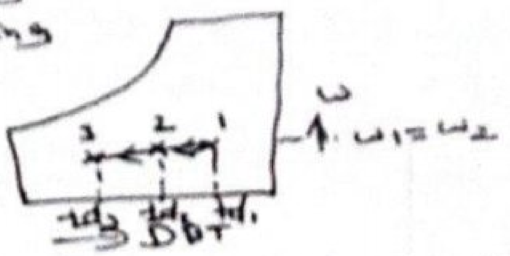
mass of air = $\frac{\text{total volume}}{\text{sp. vol}} = \frac{V}{v}$

• Sensible Cooling Process:



In sensible cooling process air passes through the cooling coil and it absorb the cooling effect from the Refrigerant and converted it into cool air.

During this process DBT decreases from td_1 to td_2. But the sp. humidity remains constant $\omega_1 = \omega_2$.



The efficiency of cooling coil is measured interms of BPF.

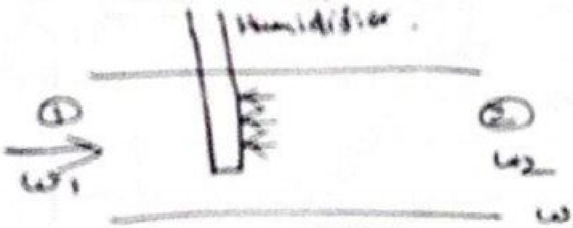
$td_1 > td_2 > td_3$

$$BPF = \frac{td_3 - td_2}{td_1 - td_2}$$

• Heat Removed from air $Q = m_a(h_1 - h_2)$

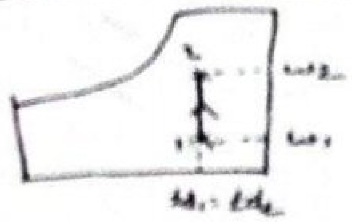
② Humidification process:

Humidification is the process of adding moisture at constant DBT. So sp. humidity increases from ω_1 to ω_2. But $td_1 = td_2$.



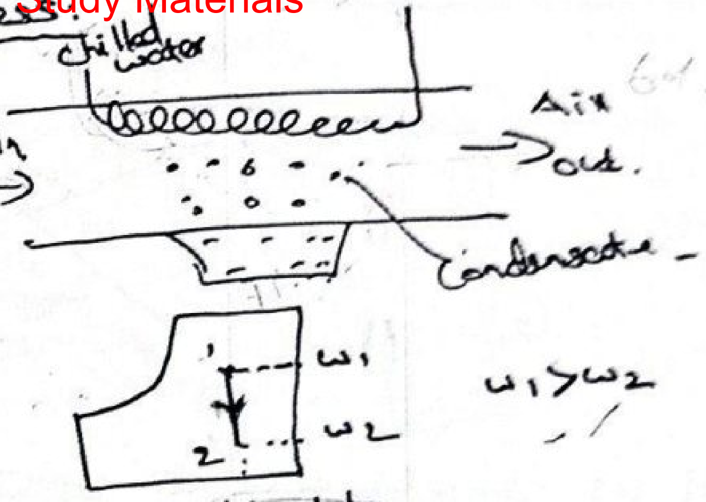
$Q = m_a(h_2 - h_1)$

$\omega_2 > \omega_1$



Dehumidification process:

is the process of Removing moisture from air by condensation.



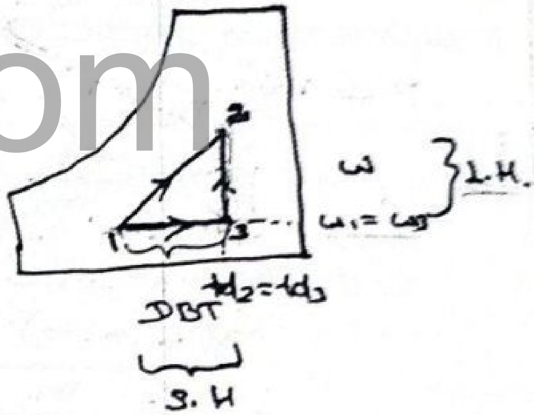
$$Q = m_a(h_1 - h_2)$$

$\omega_1 > \omega_2$

$td_1 = td_2$

③ Heating and Humidification:

In Heating & humidification process air is first passed through heating coil. First heating is done. During heating the DBT increases from $td_1 - td_2$; next humidification is done by adding moisture with const. DBT.

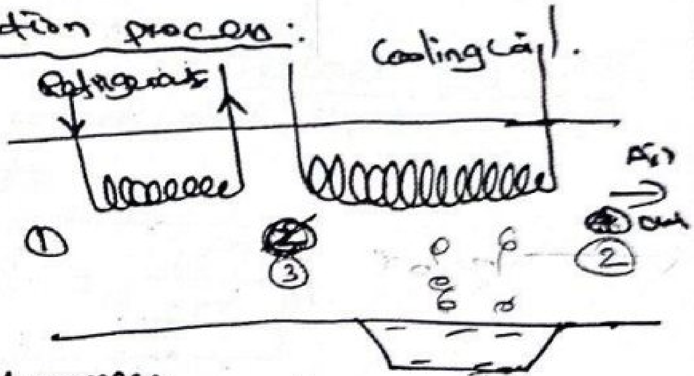


$$SHF = \frac{SHL}{SHL + LHL}$$

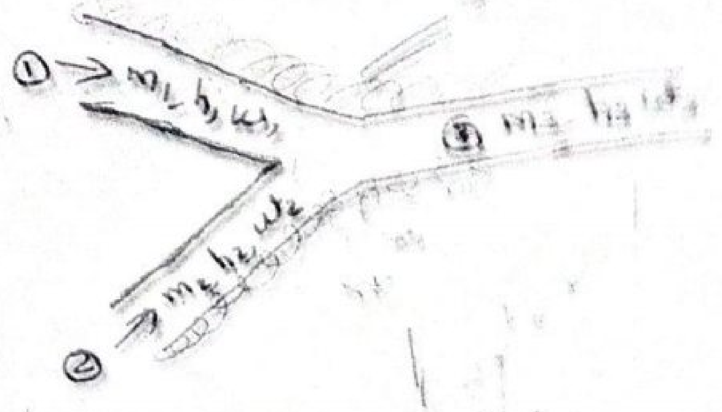
$$= \frac{h_3 - h_1}{(h_3 - h_1) + (h_2 - h_3)}$$

⑥ Cooling and dehumidification process:

First the air is cooling by using Refrigerant. During this time DBT decreased from td_1 to td_2 but sp. humidity is constant. Then the air is pass through the cooling coil for Removing the moisture by condensation.



(7) Adiabatic mixing process



Let us consider two air streams 1 and 2 mixing adiabatically.

m_1 = mass of air entering at 1
h_1 = Enthalpy of " "
w_1 = sp. humidity " "

Similarly m_2, h_2, w_2 = Corresponding values of air entering at 2,
m_3, h_3, ω_3 = Corresponding values of the mixture leaving at 3.

mass balance

$$m_1 + m_2 = m_3$$

Mass balance for water vapour

$$m_1\omega_1 + m_2\omega_2 = m_3\omega_3$$
$$= (m_1+m_2)\omega_3 \quad [\because m_3 = m_1+m_2]$$

$$m_1\omega_1 + m_2\omega_2 = m_1\omega_3 + m_2\omega_3$$

$$m_1\omega_1 - m_1\omega_3 = m_2\omega_3 - m_2\omega_2$$

$$m_1(\omega_1 - \omega_3) = m_2(\omega_3 - \omega_2)$$

$$\boxed{\frac{m_1}{m_2} = \frac{\omega_3 - \omega_2}{\omega_1 - \omega_3}} \quad (x)$$

Energy Balance:

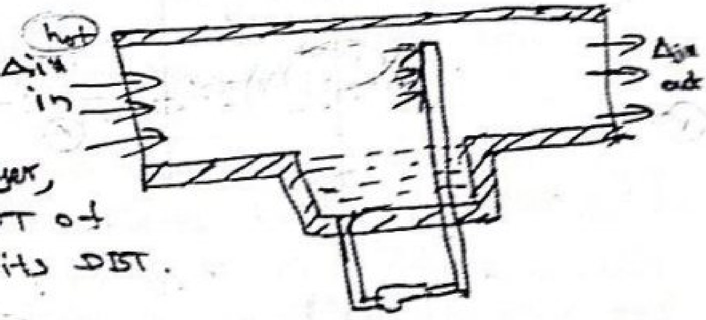
$$m_1h_1 + m_2h_2 = m_3h_3$$
$$= (m_1+m_2)h_3 \quad [m_3 = m_1+m_2]$$

$$\boxed{\frac{m_1}{m_2} = \frac{h_3 - h_2}{h_1 - h_3}}$$

$$\boxed{\frac{m_1}{m_2} = \frac{h_3 - h_2}{h_1 - h_3} = \frac{\omega_3 - \omega_2}{\omega_1 - \omega_3}}$$

② Evaporative Cooling Process

In this process air is passed through an insulated chamber. This insulating chamber has sprayer, in which temp higher than DPT of entering air but lower than its DBT.



$DPT_{entering\ air} < T_{water} < DBT_{entering\ air}$

$$\text{Effectiveness} = \frac{\text{Actual drop in DBT}}{\text{Ideal drop in DBT}} = \frac{td_1 - td_3}{td_1 - td_2}$$

Line parallel to (WBT) - line towards sat. curve.

AU.

1. An air water vapour mixture enters an air conditioning unit at a pressure of 1 bar, 30°C DBT, and a relative humidity of 75%. The mass of dry air entering is 1 kg/s. The air-vapour mixture leaves the air conditioning unit at 1 bar, 18°C, 85% R.H. Determine the heat transfer rate for the process.

G.D

$P_b = 1\,bar$

DBT $= t_{d_1} = 30°C$

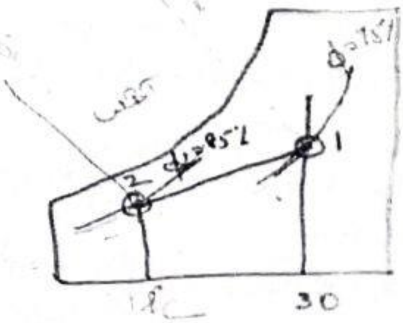
$\phi_1 = 75\%$

$m = 1\,kg/s$

$P_2 = 1\,bar$

$t_{d_2} = 18°C$

$\phi_2 = 85\%$



To find: Q

$$Q = m(h_1 - h_2)$$

From psychrometric chart.

$h_1 = 82\,kJ/kg$

$h_2 = 46\,kJ/kg$

$Q = 1(82 - 46)$

$Q = 36\,kJ/kg$

2. 75 m³ of air per minute at 20°C and 60% R.H heated until its temp. becomes 35°C. Calculate

(i) R.H. of the heated air ϕ_2

(ii) Heat added. $Q = m(h_2 - h_1)$

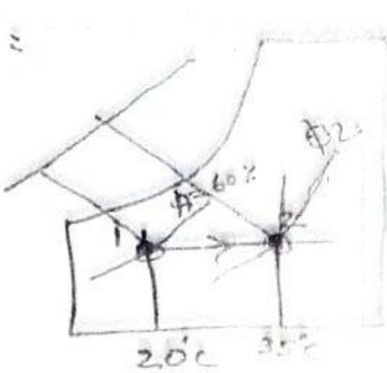
G.D:

$V_1 = 75\,m^3/min \times \frac{75}{60}\,m^3/s = 1.25\,m^3/s$

$t_{d_1} = 20°C$

$\phi_1 = 60\%$

$t_{d_2} = 35°C$



To find: ϕ_2, Q

$$Q = m(h_2 - h_1)$$

From psychrometric chart

$h_1 = 43\,kJ/kg$

$h_2 = 60\,kJ/kg$ $\quad v_1 = 0.84\,m^3/kg$

$$m = \frac{V_1}{v_1} = \frac{1.25}{0.85} = 1.478\ \frac{m^3}{s} \times \frac{kg}{m^3}$$

$m = 1.47\,kg/s$

$$Q = m(h_2 - h_1)$$
$$= 1.488(60 - 45)$$
$$\boxed{Q = 22.05 \text{ KJ/s (or) KW}}$$

$\phi_2 = 25\%$

The atm. air at 1 bar, dry bulb temp 15°C and WBT 10°C enters a heating coil whose temp is 45°C assuming by pass factor of heating coil is 0.45. Determine DBT, WBT, ϕ_2 of the air leaving the coil and the sensible heat added to air per kg of dry air.

G.D:

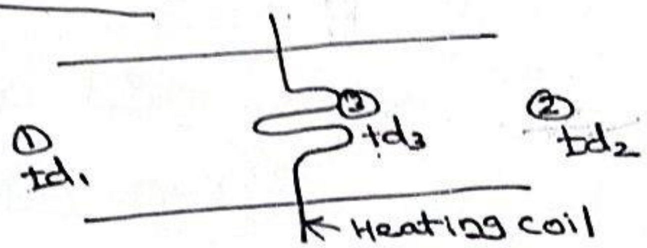
$P_1 = 1$ bar

$t_{d1} = 15°C$ $\quad m = 1$ kg

$t_{w1} = 10°C$

$t_{d3} = 45°C$

BPF = 0.45

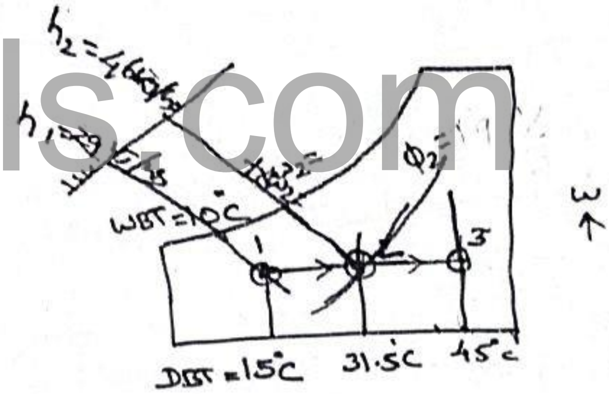


To find:

$t_{d2}, t_{w2}, \phi_2, Q$

$t_{d1} < t_{d2} < t_{d3}$

Solution:



$$BPF = 0.45 = \frac{t_{d3} - t_{d2}}{t_{d3} - t_{d1}}$$

$$0.45 = \frac{45 - t_{d2}}{45 - 15}$$

$$13.5 = 45 - t_{d2}$$

$$t_{d2} = 45 - 13.5$$

$$\boxed{t_{d2} = 31.5°C}$$

$t_{w2} = 16.5°C$

$\phi_2 = 19\%$

$Q = m(h_2 - h_1)$

$h_1 = 29$ KJ/kg

$h_2 = 46$ KJ/kg

$Q = 1(46 - 29)$

$$\boxed{Q = 17 \text{ KJ/kg}}$$

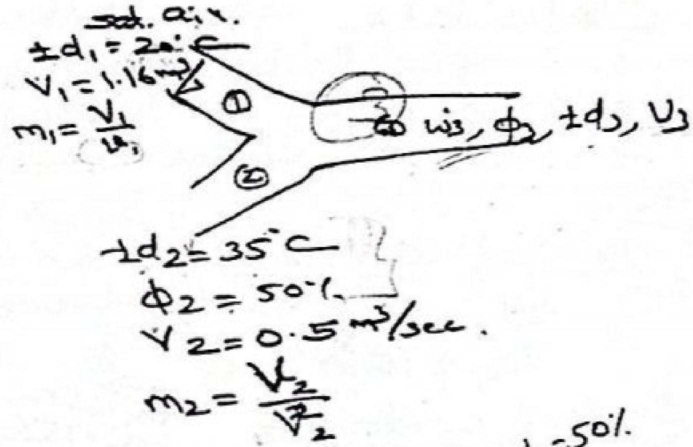
$$\frac{V}{v} = m = \frac{m^3}{s} \times \frac{kg}{m^3} = kg/s$$

Saturated air at 20°C at a rate of 1.16 m³/sec is mixed adiabatically with the outside air at 35°C and 50% RH at a rate of 0.5 m³/sec. Assuming adiabatic mixing condition at 1 atm pressure, Determine sp. humidity, RH, DBT and Volume flow rate of the mixture.

G.D

Saturated air
$td_1 = 20°C$
$V_1 = 1.16\ m^3/sec$

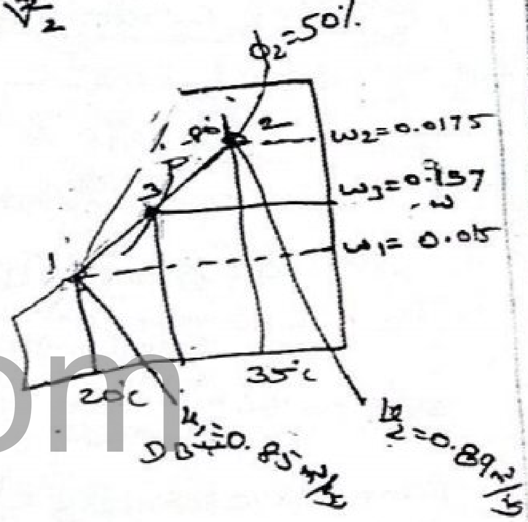
$td_2 = 35°C$
$\phi_2 = 50\%$
$V_2 = 0.5\ m^3/sec$



To find:
$\omega_3, \phi_3, td_3, V_3$

Solution:

$$\frac{m_1}{m_2} = \frac{\omega_3 - \omega_2}{\omega_1 - \omega_3}$$



$$\frac{V_1/\upsilon_1}{V_2/\upsilon_2} = \frac{\omega_3 - \omega_2}{\omega_1 - \omega_3}$$

$\omega_1 = 0.015$, $\omega_2 = 0.0175$, $V_1 = 1.16$, $\upsilon_1 = 0.85$, $V_2 = 0.5$, $\upsilon_2 = 0.89$

$$\frac{1.16/0.85}{0.5/0.89} = \frac{\omega_3 - 0.0175}{0.015 - \omega_3}$$

$\frac{m^3}{s} \times \frac{kg}{m^3} = kg/sec$

$$\frac{1.368}{0.5618} = \frac{\omega_3 - 0.0175}{0.015 - \omega_3}$$

$2.43(0.015 - \omega_3) = \omega_3 - 0.0175$

$0.03645 - 2.43\omega_3 = \omega_3 - 0.0175$

$0.03645 + 0.0175 = \omega_3 + 2.43\omega_3$

$= \omega_3(1 + 2.43)$

$0.05395 = 3.43\omega_3$

$\boxed{\omega_3 = 0.0157}$

$m_3 = \frac{V_3}{\upsilon_3}$

$\phi_3 = 80\%$

$td_3 = 25°C$

$m_3 = \frac{V_3}{\upsilon_3}$

$V_3 = m_3 \times \upsilon_3$
$= (m_1 + m_2) \times 0.86$
$= (1.36 + 0.5618) \times 0.86$
$= 1.65\ m^3/sec$

6. An air conditioning system is designed under the following conditions:
Outdoor condition → 32°C DBT and 75% RH ①
Indoor condition → 22°C DBT and 70% RH ②
Amount of free air circulated is 200 m³/min
Coil dew point temp is 14°C.
The Required Condition is achived by first Cooling and dehumidifying and then heating. Calculate the following.
1. Capacity of Cooling Coil in Tonns.
2. capacity of heating coil.
3. Mass of water vapour removed in kg/sec.

G.D

Outdoor conditions:

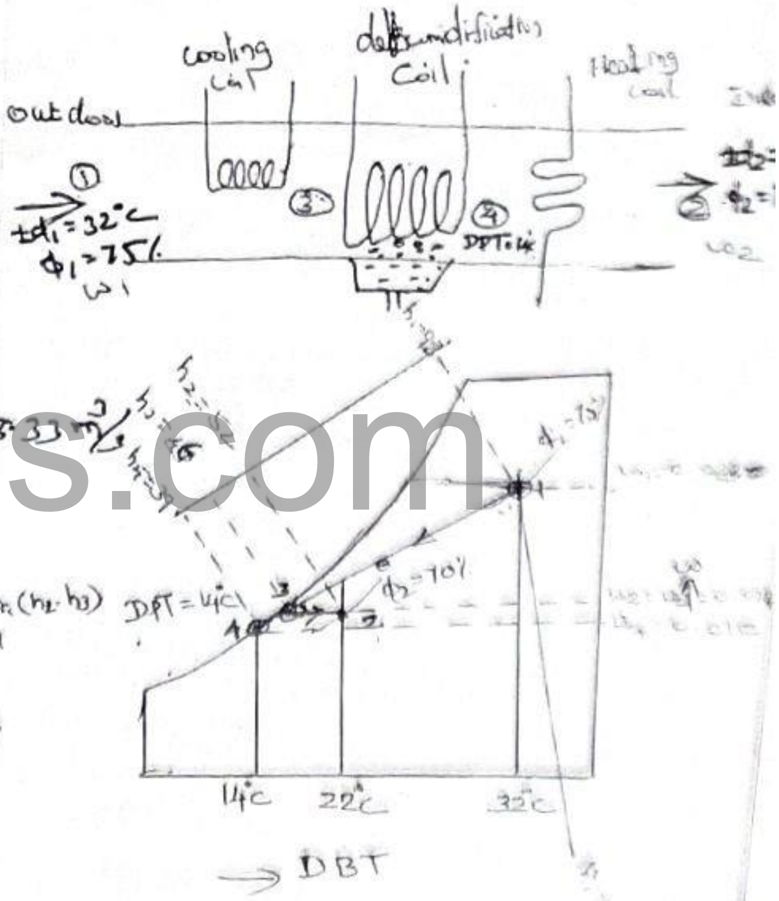
$t_{d1} = 32°C$
$\phi_1 = 75\%$

Indoor conditions

$t_{d2} = 22°C$
$\phi_2 = 70\%$

$V_1 = 200 m^3/min = 3.33 m^3/s$

DPT (or) $t_3 = 14°C$



To find: (i) cooling coil cap.
$Q = m_a(h_1 - h_3)$
(ii) Heating Coil cap $Q = m_a(h_2 - h_3)$
(iii) mass of water vap. Removed
$= m_a(\omega_1 - \omega_2)$

Solution:

From psychrometry chart

$h_1 = 92 \ kJ/kg$
$h_2 = 52 \ kJ/kg$
$h_3 = 46 \ kJ/kg$
$h_4 = 39 \ kJ/kg$

and $\omega_1 = 0.028$ kg/kg of dry air.
$\omega_2 = \omega_3 = 0.0115$ kg/kg of dry air.
$\omega_4 = 0.010$ kg/kg of dry air.

$$m_a = \frac{V_1}{v_1} = \frac{3.33}{0.87} = 3.74 \ kg/s$$

(i) Cooling coil cap $Q = m_a(h_1 - h_3)$ 172.04
$= 3.74(92 - 46) =$ ~~160.84~~ kJ/sec (1 Tonne = 3.5 kJ/s)
$= \frac{160.84}{3.5} =$ ~~45.94 Tonnes~~
$= \frac{172.04}{3.5} = 49$ Tonnes

(ii) Heating Coil Capacity $Q = m_a(h_2 - h_3)$

$= 3.74(52-47)$

$Q = 18.7\ KJ/s$

(iii) Mass of water vapour Removed:

$= m_a(\omega_1 - \omega_2)$

$= 3.74(0.0225 - 0.012)$ (0.023 − 0.0115)

$= 0.03927\ kg/sec = 0.04301\ kg/s$

Air at 16°C and 25% RH passes through a heater and then through a humidifier to reach final dry bulb temperature of 30°C and 50% RH. Calculate the heat and moisture added to the air. And what is the sensible heat factor.

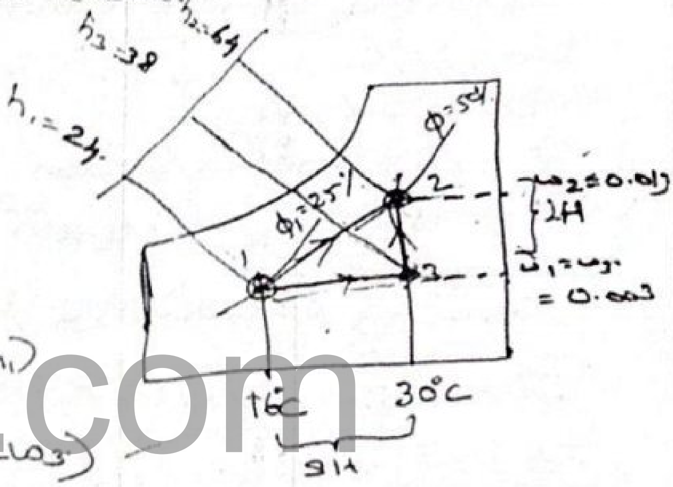
G.D:

$td_1 = 16°C$

$\phi_1 = 25\%$

$td_2 = 30°C$

$\phi_2 = 50\%$



To find:

Heat added $Q = m(h_3 - h_1)$

Moisture added $\omega = m(\omega_2 - \omega_3)$

Solution:

From psychrometric chart

$h_1 = 24\ KJ/kg$

$h_2 = 64\ KJ/kg$

$h_3 = 38\ KJ/kg$

$\omega_2 = 0.013\ kg/kg$ of dry air

$\omega_1 = \omega_3 = 0.003\ kg/kg$ of dry air.

Heat added $Q = h_3 - h_1$

$= 38 - 24 = 14\ KJ/kg.$

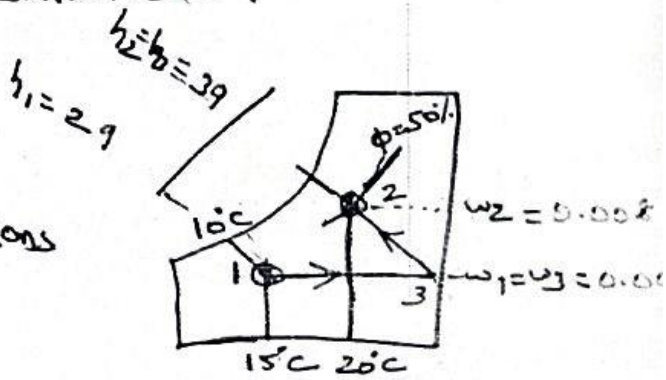
Moisture added $\omega = \omega_2 - \omega_3 =$

$= 0.013 - 0.003$

$\omega = 0.01\ kg/kg$ of dry air.

① An airconditioning system is designed under the following conditions.
out door Conditions 15°C DBT and 10°C WBT
Required Conditions 20°C DBT and 50% RH.
Amount of free air circulated 0.25 m³/min/person
Seating capacity 50 persons.
The required conditions is achieved first by heating and then by adiabatic humidifying. Determine the following,
(i) Capacity of heating coil in kW.
(ii) Capacity of humidifier.

G.D:



Out door conditions
$td_1=15°C$
$tw_1=10°C$
Required Indoor conditions
$td_2=20°C$
$\phi_2=50\%$
$V=0.25\ m^3/min/person$
$V=\frac{0.25}{60}=4.17\times10^{-3}\ m^3/s/person.$
Seating capacity is 50 person.
So $V=4.17\times10^{-3}\times50=0.208\ m^3/sec.$

To find:
(i) $Q=m_a(h_3-h_1)$
(ii) $\omega=m_a(\omega_2-\omega_1)$

Sol:
From psychrometric chart.
$h_1=29\ KJ/Kg$
$h_2=h_3=39\ KJ/Kg$
$\omega_1=\omega_3=0.0055$ kg/kg of dry air.
$\omega_2=0.008$ kg/kg of dry air.

(i) $Q=m_a(h_3-h_1)$

$$m_a=\frac{V_1}{v_1}=\frac{0.208}{0.825}=0.2521\ kg/s$$

$Q=0.2521(39-29)$

$Q=2.521\ KJ/s$ or KW

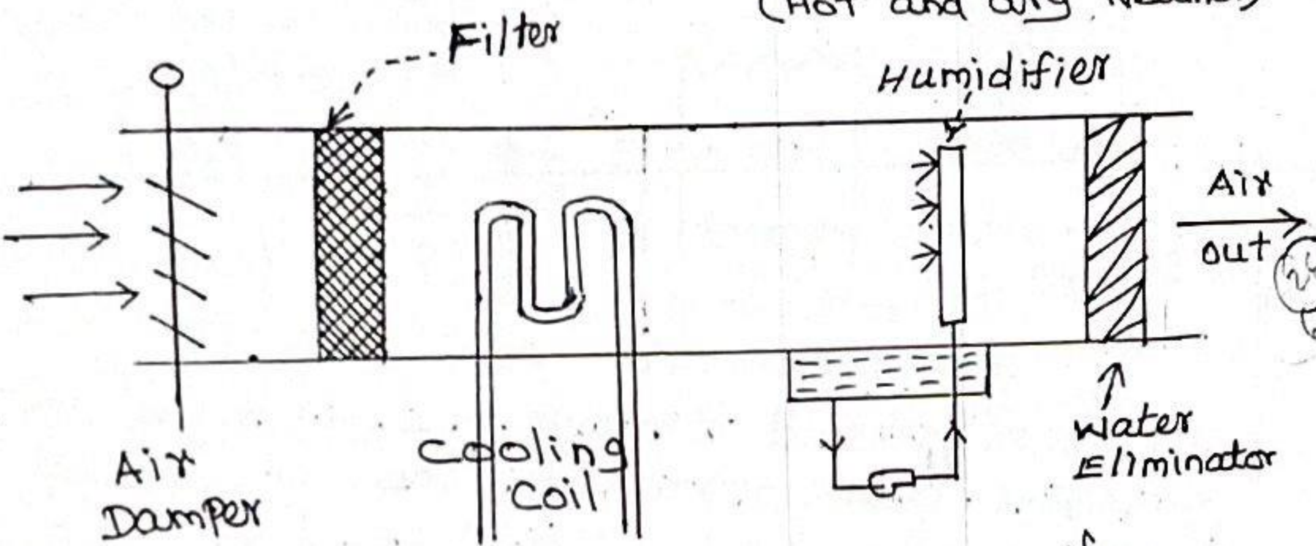
(ii) $\omega=m_a(\omega_2-\omega_1)=0.2521(0.008-0.0055)$

$\omega=6.30\times10^{-4}$ kg/kg of dry air

Application of Air Conditioning System

1. Summer Air-Conditioning system:

(HOT and dry weather)

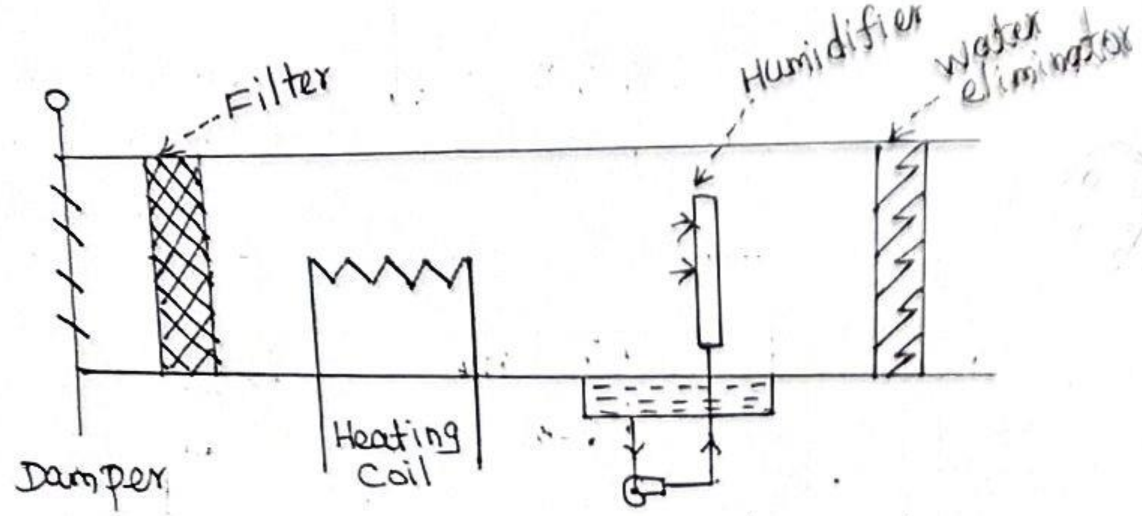


During hot and dry weather, the air is first passed through air filter to remove dust and then passed through the cooling coil for removing the heat from the air, and then passed through the humidifier for increasing the relative humidity and attain the human comfort condition (26°C and $\phi = 60\%$).

This system contains the

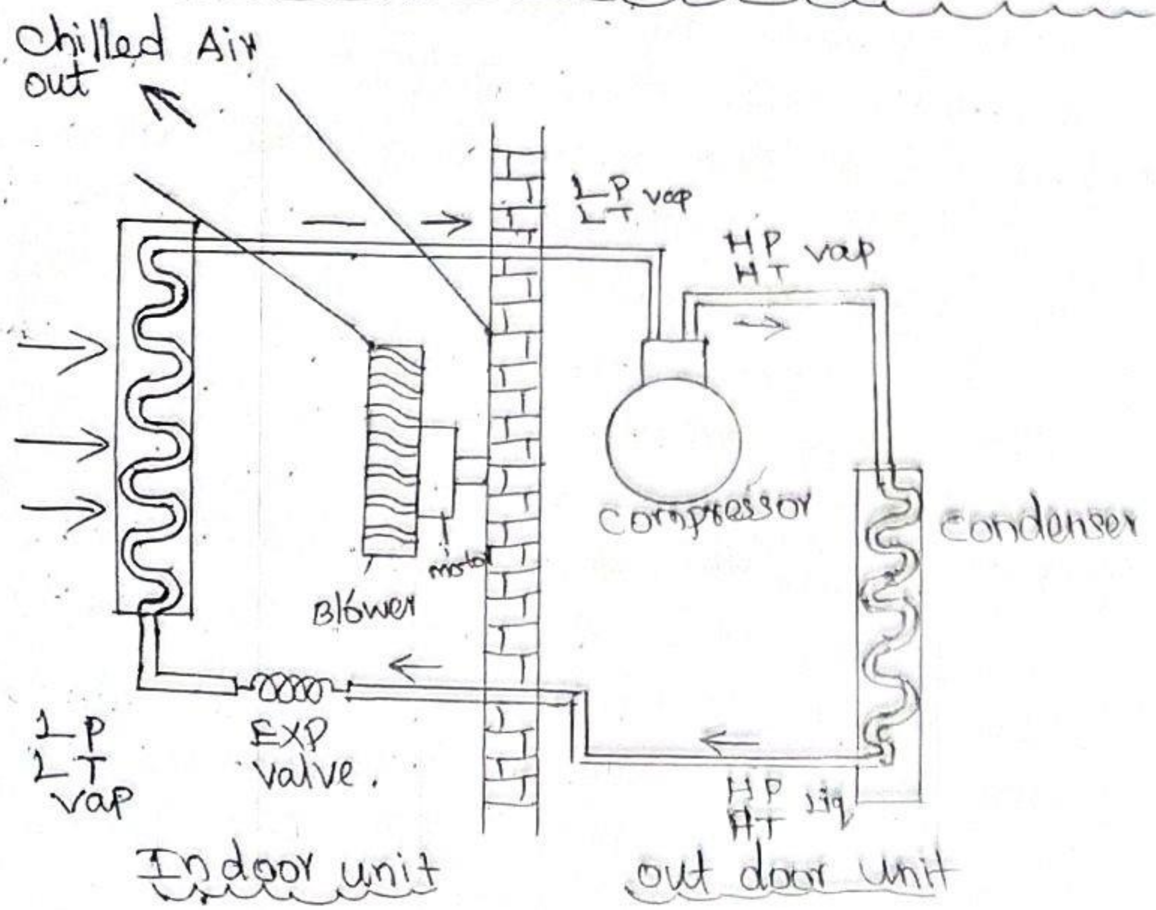
Damper — controll the air supply
Filter — Remove dust from air
cooling coil — To reduce the air Temp.
Humidifier — To increase the sp. humidity.
Water Eliminator — Prevent the water particles enter into the Room.

2. Winter Air conditioning system: (Low R.H)



During winter Air conditioning air first passed through the air filter for removing dust from air. Then air passed through the heating coil and humidifier to attaining human comfort condition.

(X) Window A/C (or) Room A/c. (or) unitary A/C



Air Conditioning System Contains 4-important components.

1. Compressor
2. Condenser
3. Expansion valve
4. Evaporator.

And it contains 2-units. outdoor unit and Indoor unit. Compressor and condenser are located at the out door unit and the expansion valve and Evaporator are located at the Indoor unit.

First the compressor, compress the refrigerant and convert it into High pressure and High temperature vapour refrigerant. Then it is enter into the condenser. Condenser convert the High pressure and high Temperature vapour refrigerant into High pressure and High temperature liquid refrigerent. Then it enters into the Expansion valve, here it converted into Low pressure and low temperature vapour refrigerant. Then this coolest refrigerent goes through the evaporator and enters into the compressor.

When the blower is running it suck the air from the room, this air pass through the evaporator coil and absorb the cooling effect from the refrigerent, and converted into cool air, then it is recirculated into the Room.