

Air Conditioning System:

This deals with the study of conditioning of air i.e. supplying and maintaining desirable internal atmospheric conditions for human comfort, irrespective of external condition.

The system which effectively controls temp of air, humidity of air, purity and motion of air to produce the desired effects upon the occupants of the space is known as an air "conditioning system".

Equipments used in an Air conditioning system:

- 1- Circulation fan
- 2- Air conditioning unit
- 3- Supply duct
- 4- Supply outlets
- 5- Return outlets
- 6- filters

Application of air conditioning system:

Air conditioning has numerous applications in industry. Air conditioning is required for provide comforts to the workers, preserve food during storage and transportation, drying of products, necessary low temp. conditions required for manufacturing of certain products.

Some industrial applications are:

- 1- Textile industry
- 2- Photographic industry
- 3- Printing industry
- 4- Food industry

Comfort conditions [Human comfort][comfort air conditioning]:
Human comfort depend upon physiological and psychological condition. Thus it is difficult to define the term human comfort:

According to ASHRAE [American Society of Heating Refrigeration and Air conditioning Engineers] "Human comfort is that condition of mind, which expresses satisfaction with the thermal environment."

Four important factors for comfort air conditioning are as below:

- 1- Temperature of air: It may be noted that human being feels comfortable when the air temp. is 21°C to 30°C .
- 2- Humidity of air: The control of humidity means the decreasing or increasing of moisture contents of air.
In general, for summer air conditioning the relative humidity should not be less than 60% whereas for winter air conditioning it should not be more than 40%.
- 3- Purity of air: It is thus obvious that proper filtration, cleaning and purification of air is essential to keep it free from dust and other impurities.
- 4- Motion of air: It is necessary that there should be equi-distribution of air throughout the space to be air conditioned.

Psychrometry:

The psychrometry is that branch of engineering science which deals with the study of moist air i.e. dry air mixed with water vapour or humidity.

Dry air: The pure dry air is a mixture of a number of gases such as nitrogen, oxygen, hydrogen, argon etc.

Moist air: It is a mixture of dry air and water vapour.

Saturated air: It is a mixture of dry air and water vapour when the air has diffused the maximum amount of water vapour into it.

Humidity: It is the mass of water vapour present in 1 kg. of dry air, expressed in terms of "gm/kg of dry air". It is also called "specific humidity" or "humidity ratio".

$$W = m_v / m_a$$

Absolute humidity: It is the mass of water vapour present in 1 m^3 of dry air, expressed in terms of "gm/ m^3 of dry air".

Relative humidity: It is the ratio of actual mass of water vapour in a given volume of moist air to the mass of water vapour in the same volume of saturated air at the same temp. and pressure. It is written as RH.

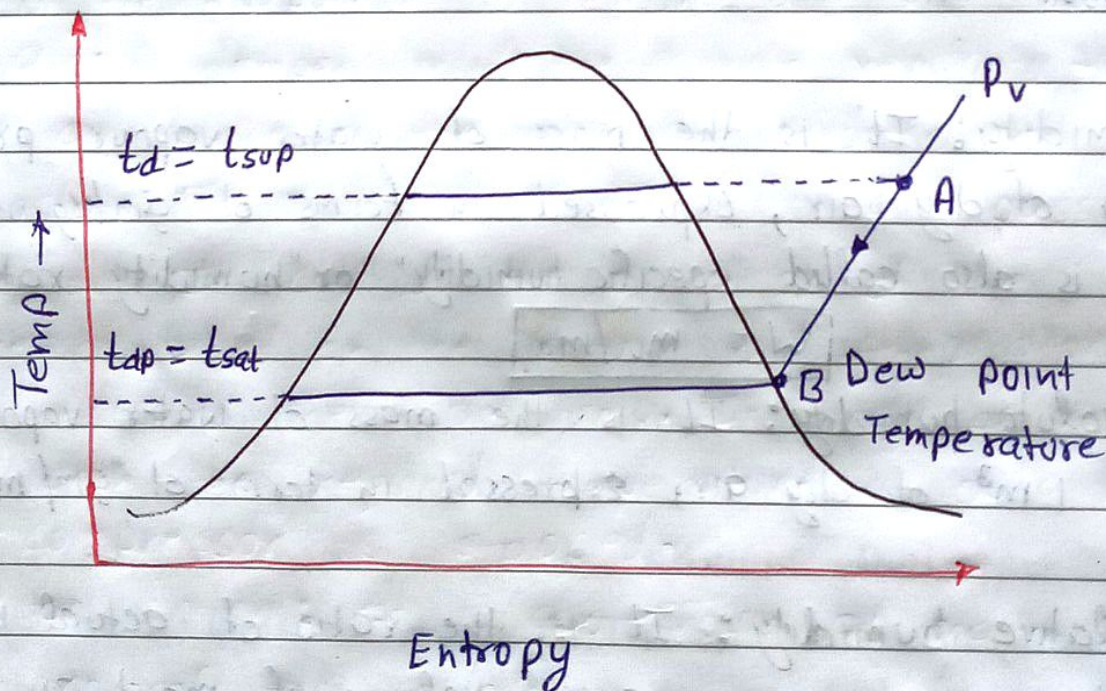
$$\phi = \frac{m_v}{m_s} = \frac{p_v}{p_s}$$

Dry bulb temperature: It is the temp. of air recorded by a thermometer, when it is not affected by the moisture present in the air; briefly written as DBT & denoted by t_d or t_{db} .

Wet bulb temperature: It is the temperature of air recorded by a thermometer when its bulb is surrounded by a wet cloth exposed to air, briefly written as 'WBT' & denoted by t_w or t_{wb} .

Dew point temperature: It is the temp. of air recorded by a thermometer, when the moisture (water vapour) present in it begins to condense. It is denoted by t_{dp} .

NOTE: For saturated air, the dry bulb temp., wet bulb temp. and dew point temp. is same.



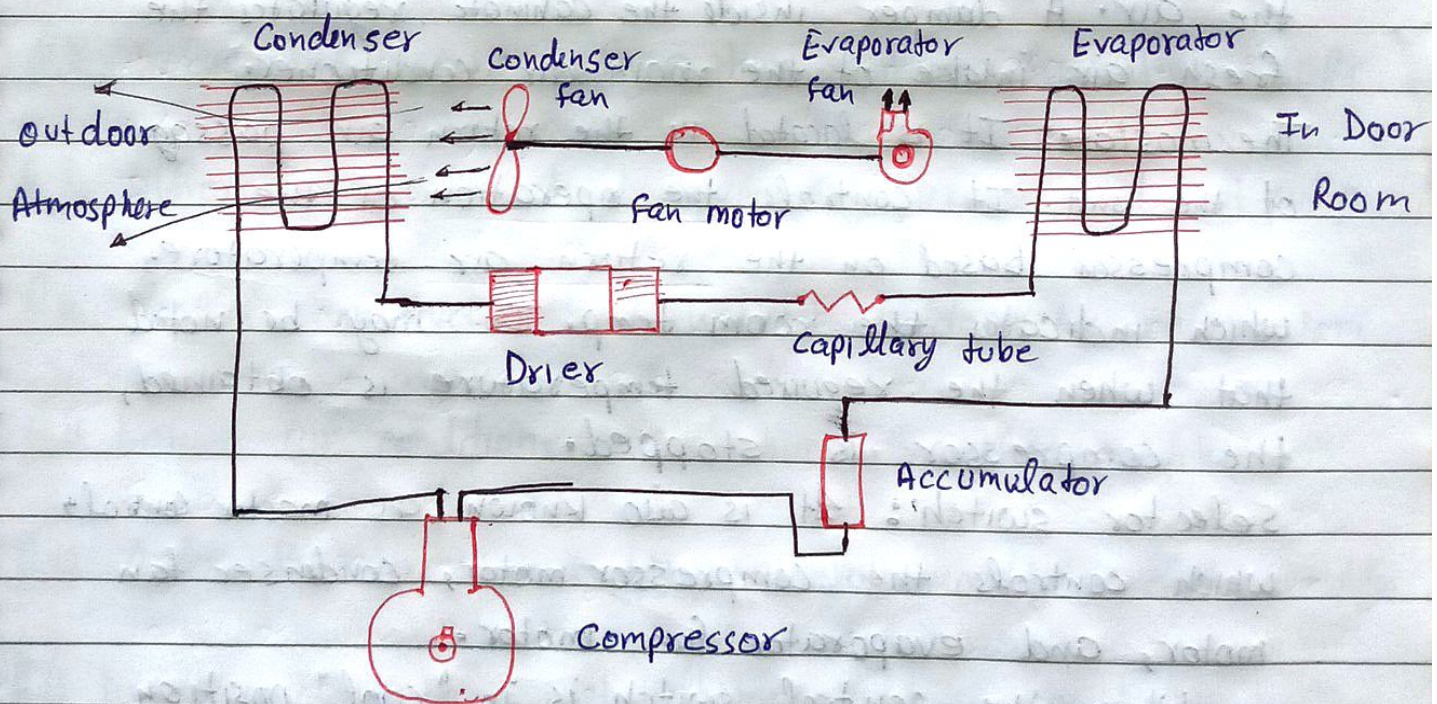
Psychrometer: Psychrometer is used to measure dry bulb temperature and wet bulb temperature. It consists of a dry bulb thermometer and wet bulb temperature thermometer side by side.

Construction and working of room air conditioner:

A room air conditioner is a compact, self contained air conditioning unit which is normally installed in a window or wall opening.

A complete unit of a room air conditioner consists of a refrigeration system, the control system (thermostat and selector switch), electrical protection system (motor overload switches and winding protection thermostat on the compressor motor), air circulation system (fan motor, centrifugal evaporator blower), ventilation (fresh air damper) and exhaust system.

Its working on vapour compression cycle. The refrigerant used is R-12 and R-22.



Compressor: Air conditioner system consists of a hermetic type compressor, a winding thermostat is embedded in the compressor motor windings. It puts off the compressor if the winding temp. exceeds the safe limit, thus protecting the winding against high temperature.

Condenser: A condenser is a continuous coil made of copper tubing with aluminium fins attached to it to increase the heat transfer rate [rejecting heat to atmosphere]. A propeller type fan provides the necessary air to cool the refrigerent and also exhausts air from the air-conditioned space when exhaust damper is opened.

Evaporator: The evaporator is a cooling coil also made of copper with aluminium fins attached to it to increase the heat transfer rate [taking in heat from the room air]. Evaporator faces the room.

A filter is installed on the fresh air entering side of the evaporator to remove any dirt from the air. A damper inside the cabinete regulates the fresh air intake of the room air conditioner.

Thermostat: It is located in the return air passage of the unit. It controls the operation of the compressor based on the return air temperature, which indicates the room temp. It may be noted that when the required temperature is obtained, the compressor is stopped.

Selector switch: It is also known as master controls, which controls the compressor motor, condenser fan motor, and evaporator fan motor.

When the control switch is in "cool" position, all the motors are in working state and cool air is supplied to the room.

When the control switch is in "ventilate" position, only evaporator blower motor operates.

Q.1. Define heat engine. State types of heat engine.

Q.2. Explain basic components of engine.

Q.3. Construction and working of four stroke SI Engine.

Q.4. Difference between 4-stroke and 2-stroke engine.

Q.5. Difference between SI and CI Engine.

Q.6. Define scavenging process.

Q.7. Explain electric and hybrid electric vehicle.

Q.8. Define the terms: refrigeration, unit of refrigeration, & COP.

Q.9. Difference between heat engine, refrigerator and heat pump.

Q.10. Explain construction and working of domestic refrigerator.

Q.11. Define air conditioner and human comfort condition.

Q.12. Define the terms: humidity, absolute humidity & relative humidity.

Q.13. Define dry bulb temp, wet bulb temp and dew point temp.

Q.14. Explain construction and working of window air conditioning.

Q.15. Explain construction and working of two stroke engine.