REFRIGERATION AND AIR CONDITIONING

1. Define 1 ton of refrigeration (1 TR).

Ans: It is defined as, the amount of heat extracted to convert one ton of water into one ton of ice in the duration of 24 hrs and maintaining at 0^0C.

1 ton = 1000 kg

$$1\ TR = \frac{1000kg \times 336\ kj/kg}{24\ hrs}$$

$$1\ TR = \frac{1000kg \times 336\ kj/kg}{24 \times 60\ mins}$$

1 TR = 233.33 kj/min

1 TR ≈ 210 kj/min

2. Write definitions of a) Specific humidity b) Dew point temperature (DPT)

c) Relative humidity.

Ans: **a) Specific humidity:** Specific humidity (or moisture content) is the ratio of the mass of water vapor to the total mass of the air parcel

b) Dew point temperature (DPT): The dew point is the temperature the air needs to be cooled at constant pressure in order to achieve a relative humidity of 100%. At this point the air cannot hold more water in the gas form

c) Relative humidity: Relative humidity (RH) (expressed as a percent) also measures water vapour, but RELATIVE to the temperature of the air. In other words, it is a measure of the actual amount of water vapour in the air compared to the total amount of vapour that can exist in the air at its current temperature.

3. A machine working on Carnot cycle operates between 350K and 269K. Determine the COP.

Ans: $COP_{carnot} = \frac{T1}{T2-T1}$

$$= \frac{269}{350-269}$$

$$= 3.32$$

4. Define the following terms: a) refrigeration effect (N) b) COP

Ans: **a) Refrigeration effect (N):** It is defined as the quantity of heat extracted from a space or system to be cooled in a given time

$$\text{Refrigeration effect (N)} = \frac{\text{Heat extracted}}{Given\ time}$$

Units: J/s or kJ/s

b) COP: The effectiveness of a refrigerator is determined by coefficient of performance. It is the ratio of refrigerating effect (N) to the work input (W)

$$\text{COP} = \frac{\text{Refrigeration effect (N)}}{Work\ input\ (W)} = \frac{\text{N}}{W}$$

5. What are the important psychometric processes?

Ans: i) Sensible heating

ii) Sensible cooling

iii) Humidification and dehumidification

iv) Heating and humidification

v) Heating and dehumidification

vi) Cooling and humidification

vii) Cooling and dehumidification

6. What are the four processes in Bell-Coleman cycle.

Ans: **i)** Isentropic compression (or) Reversible adiabatic compression

ii) Constant pressure heat rejection

iii) Isentropic expansion (or) Reversible adiabatic expansion

iv) Constant pressure heat addition

7. Name some secondary refrigerants.

Ans: i) Water

ii) Brine solution ($Cacl_2$ or Nacl)

8. What is the purpose of condenser in refrigeration system.

Ans: The condenser is used for condensation purpose that means it converts vapour refrigerant to liquid refrigerant by releasing its heat to the cooling medium

9. Write the various applications of refrigeration's?

Ans: i) Preservation of perishable products (such as fruits, vegetables, fish, meat etc.) during storage or transportation

ii) Manufacturing of ice or dry ice

iii) Preservation of medicines, blood and human organs

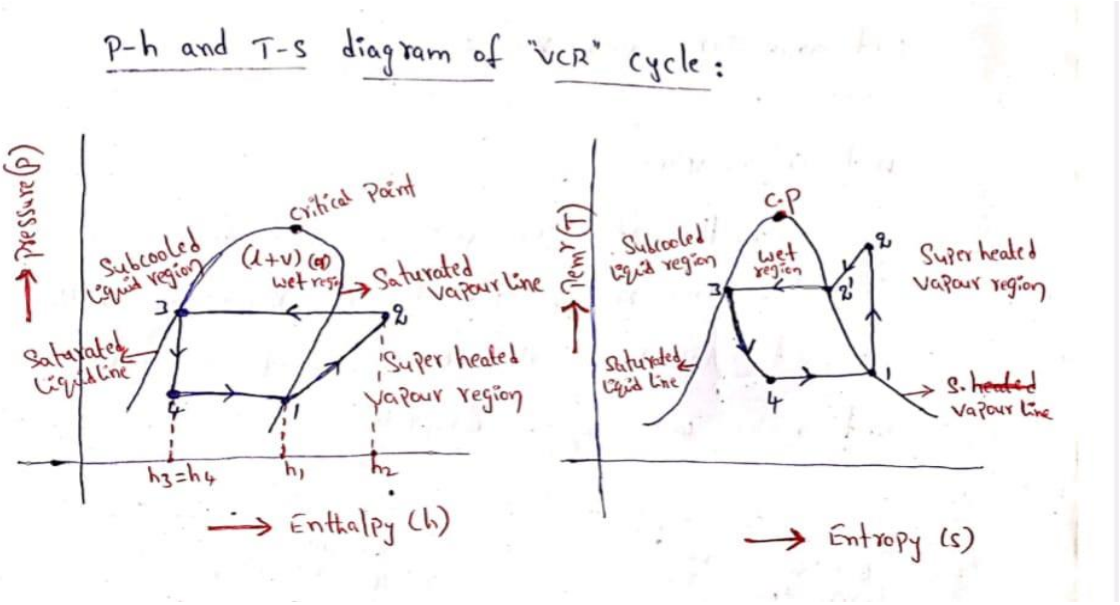
iv) For smooth running of computers and ATM machines etc

v) In chemical and textile industries

vi) Control of air temperature and humidity in air-conditioning systems

10. Draw the P-H &T-S diagrams for vapour compression refrigeration cycle.

Ans:



11. What are the basic components of VCR system?

Ans: i) Compressor: used to compress the vapour refrigerant

ii) Condenser: used for the condensation of vapour refrigerant

iii) Expansion valve: used to expand the liquid refrigerant

iv) Evaporator: Placed around the products to be cooled

12. Define adiabatic de-humidification process.

Ans: During this stage of the procedure, the air is subjected to a chemical interaction for one time. The moisture in the air can be extracted by condensing it. Chemical dehumidification is the term that describes this procedure.

13. Write different types of refrigeration methods.

Ans: The following are the different types of refrigeration methods:

i) Ice refrigeration

ii) Dry ice refrigeration

iii) Air expansion refrigeration

iv) Evaporative refrigeration

v) Gas throttling refrigeration

vi) Liquid nitrogen refrigeration

vii) Steam-jet refrigeration

viii) Vapour compression refrigeration

ix) vapour absorption refrigeration

14. What are Flash chamber & Accumulator?

Ans: **Flash chamber:** Flash chamber is fitted in between the expansion valve and evaporator in VCR cycle. The function of flash chamber is during expansion, some amount of vapour refrigerant formed. The flash chamber separates that vapour refrigerant and sends directly to the compressor bypassing the evaporator. This arrangement reduce the mass of refrigerant entering into the evaporator reducing the size of it.

Accumulator: Accumulator is fitted in between the evaporator and compressor. After evaporation some liquid particles present in vapour refrigerant. Accumulator prevents the entry of liquid refrigerant into the compressor. It allows dry vapour refrigerant to pass into the compressor.

15. What re the advantages of vapour absorption system over vapour compression system?

Ans: In conclusion, absorption refrigeration offers some energy efficiency, environmental, and maintenance advantages over conventional vapour compression systems.

However, they also come with drawbacks such as higher initial costs, lower efficiency, larger size, and limited applications

16. Define degree of saturation.

Ans: The degree of saturation is the amount of water present in the air relative to the maximum amount it can hold at a given temperature without causing condensation.

17. Name different types of expansion valves.

Ans: i) Automatic expansion valve

ii) Thermostatic expansion valve

iii) capillary tube

iv) Solenoid valve

18. Name any two types of filters used in air-conditioning.

Ans: i) Dry filters

ii) Wet filters

iii) Viscous filters

iv) Electronic filters

19. Advantages of central air conditioned system.

Ans: i) The components are located away from the conditioned space

ii) The maintenance and inspection of the system does not disturb the people in the conditioned space

iii) The system is suitable for large capacities over 25 tons.

20. What is psychrometry ? State the applications of psychrometric principles.

Ans: The study of the properties of air and water vapour mixture is called psychrometry. Psychrometric principles are applied to air conditioning systems, cooling and humidifying coils, cooling towers and evaporative condensers.