	AkhilBharatiya Maratha ShikshanParishad's **Anantrao Pawar College of Engineering & Research**	
	Record No.: ADM/D/036B **Revision: 00**	**DoI: 02/01/2023**

Internal Correspondence For Department

SUBJECT NAME - **Non-conventional Refrigerating System**

SEMESTER -5TH (Third year)

Subject in charge- Prof. Mehtre V K

Exam pattern- Insem &Endsem

Syllabus- Non-conventional Refrigerating System

1. Vapour Absorption Refrigeration System: Principle of absorption system, comparison between vapour compression system and vapor absorption system, theory of binary mixtures,

2. Aqua-ammonia vapour absorption system, theory of mixtures, temperature concentration diagram and enthalpy concentration diagram, processes used in aqua-ammonia absorption system, adiabatic mixing, separation, throttling process,

3. Vapour absorption system its components, working principle and mathematical analysis, b. Lithium-bromide- water absorption system its components, working principle, and mathematical analysis

4. Steam Jet Refrigeration System: Introduction, steam jet refrigeration system, components of steam jet refrigeration system, advantage and limitation of steam jet refrigeration system, performance of steam jet refrigeration system

5. Thermo-Electric Refrigeration System: Introduction, thermo-electric effects, Seebeck effect, Peltier effect, Thomson effect

Reference books:

1. ISHRAE standard book for Refrigeration and Air Conditioning

2. ASHRE hand book for Refrigeration and Air Conditioning

3. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House

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Notes –

1)What is the difference between vapor compression and vapor absorption refrigeration system?

Ans- The vapour compression cycle is described as a work-operated cycle because it uses a compressor that requires work in the form of electrical energy to operate. The absorption cycle is referred to as a heat-operated cycle because most of the energy required to operate the cycle is heat energy.

2) What is the principle of vapour absorption refrigeration system?

Ans- A Vapour Absorption Refrigeration System consists of four main components: an evaporator, absorber, generator, and condenser. Heat from an external source, such as a gas burner or waste heat, drives the absorption process, allowing it to create cooling effects

3) What is the principle of Vapour compression refrigeration system?

Ans- The superheated vapor then passes through the condenser. This is where heat is transferred from the circulating refrigerant to an external medium, allowing the gaseous refrigerant to cool and condense into a liquid. The rejected heat is carried away by either the water or the air, depending on the type of condenser.

4) What is the principle of adsorption refrigeration system?

Ans- In an adsorption system, an adsorber adsorbs the refrigerant vapour into a solid, while in an absorption system, an absorber absorbs the refrigerant vapour into a liquid. Adsorption refrigeration also includes a generation process where refrigerant vapour molecules desorb from the solid

5) What is the application of Vapour compression refrigeration system?

Ans- Their are utilized in the majority of refrigerators, freezers and air conditioning systems produced today. They also have practical applications as "heat pumps" a term describing an electrically powered VCRS to heat an enclosed space such as your home by transferring heat energy from outside to the inside.

6) What is the aqua ammonia vapour absorption system?

Ans-Ammonia is the refrigerant while water is used as absorbent. The absorber absorbs the low pressure ammonia vapour coming from evaporator. The cold water in absorber has the ability to absorb very large quantities of ammonia vapour and the solution formed is called 'aqua-ammonia'.

7) What is a rectifier fitted in an ammonia absorption plant to?

Ans-The rectifier is installed for the complete removal of water vapour from ammonia vapour.

8). What absorbent is used in the ammonia water vapor absorption refrigeration cycle?

Ans-The absorption chillers use either a water–lithium bromide pair (H_2O/LiBr) or an ammonia–water pair (NH–HO). The HO/LiBr system uses water as refrigerant and lithium bromide as absorbent. The ammonia–water system uses water as absorbent and ammonia as refrigerant.

9) What is the working principle of ammonia refrigeration system?

Ans-In the refrigerant cycle, ammonia gas undergoes compression through the application of the compressor. This causes the gas to heat up under pressurization. The gas moves into the condenser where heat is dissipated in the coils. This condenses the ammonia, changing it into liquid form, but still at high pressure.

10). Why rectifier is used in alternator?

Ans-Rectifier. An alternator's stator creates an Alternating Charge (AC) charge, but car batteries are powered by a Direct Current (DC) charge. The role of a rectifier is to convert the alternating electric charge into direct power that's compatible with the vehicle's battery

11) What is the working principle of vapour absorption system?

Ans- Vapor absorption system allows use of variable heat sources: directly using a gas burner, recovering waste heat in the form of hot water or low-pressure steam, or boiler-generated hot water or steam. The fundamental principle of VAM is that water boils at about 40°F at the low- pressure vacuum condition of 6.5 mm-Hg.

12) What is the working principle of lithium bromide absorption refrigeration system?

Ans- In a water-lithium bromide vapor absorption refrigeration system, water is used as the refrigerant while lithium bromide (Li Br) is used as the absorbent. In the absorber, the lithium bromide absorbs the water refrigerant, creating a solution of water and lithium bromide.

13). What is the formula for the COP of a vapour absorption refrigeration system?

Ans- The formula for the maximum coefficient of performance (COP) of a vapor absorption refrigeration system is given by COPmax = (Tg - Te) / (Tg - Tc), where Tg is the generator temperature, Te is the evaporator temperature, and Tc is the condenser temperature.

14) What is the value of COP in Vapour compression?

Ans- COP has been designed for vapour compression cycle and it is alwats greater than 1. because if it is less than 1 then the efficiency will become more than 1, which is impractical. however, in the case of vapour absorption systems, it is less than 1.

15). What is the value of R in vapour pressure?

Ans- 8.3145 J mol^{-1} K^{-1}

16) What are the components of steam jet refrigeration system?

Ans-The main components are a flash chamber, steam nozzles, ejector, and condenser. High pressure steam from a boiler passes through a nozzle, entraining vapor from the flash chamber. This mixture is compressed in the ejector and condenses, with the condensate returning to the boiler to complete the cycle.

17) What are the advantages of steam jet refrigeration system?

Ans-Advantages of Steam Jet Refrigeration System

This is non-inflammable. This can be cooled directly without any high cooling systems. This has less maintenance. This has no vibrations

18). What are the 4 main components of a refrigeration system?

Ans-compressors, condensers, evaporators, and expansion devices. It is very important that all of these components are in place and working effectively

19). What is Seebeck effect and Peltier effect and Thomson effect?

Ans- The Seebeck effect is the conversion of temperature differences into electricity, the Peltier effect is the conversion of electricity to temperature differences, and the Thomson effect is heat produced by the product of current density and temperature gradients.

20). What is a thermo-electric refrigeration system?

Ans- Thermoelectric refrigeration technology is one of the most developed NIK technologies among them. Thermoelectric refrigeration is operated by a direct current passing through a circuit formed by two dissimilar conductors or semiconductors that produce a temperature difference at the junction of two conductors.

21) What is the Peltier effect?

Ans- The Peltier effect is the reverse phenomenon of the Seebeck effect; the electrical current flowing through the junction connecting two materials will emit or absorb heat per unit time at the junction to balance the difference in the chemical potential of the two materials.

22). What is the Seebeck effect?

Ans- The Seebeck effect refers to a thermoelectric phenomenon in which the voltage difference between two materials is caused by the temperature difference between two different electrical conductors or semiconductors.

23). What is the positive Thomson effect?

Ans- Positive Thomson effect and negative Thomson effect. In the positive Thomson effect, it is found that the hot end is at high potential and the cold end is at low potential. Heat is evolved when current is passed from hotter end to the colder end and heat is absorbed when current is passed from colder end to hotter end.

MCQ ON RAC

1)What is Refrigeration?
a) Refrigeration is the process of removing heat from a substance and cooling it to a temperature or below the actual temperature
b) Refrigeration is the process of adding heat from a substance and cooling it to a temperature
c) Refrigeration is used to increase the level of humidity in the air by adding heat
d) None of the mentioned

2) How is the refrigerant used in the Air refrigeration cycle?
a**) In the compressor** b) In the condenser
c) Directly in contact d) Not used at all

3) Which of the following refers to the term C.O.P. of refrigeration?
a) Cooling for Performance **b) Coefficient of Performance**
c) Capacity of Performance d) Co-efficient of Plant

4) Which of the following is NOT the advantages of using a closed Air Refrigeration system?
a) Compact in construction **b) Lower coefficient of performance**
c) Lighter in weight d) Environmental Friendly

5) In lithium bromide absorption refrigeration system it is not necessary to keep the refrigeration temperature above 0°C.
a) False b) True

6) Which of the following is the S.I. unit to measure pressure in refrigeration?
a) Bar b) Newton c) Joule **d) Pascal**

7) Which of the following is the main disadvantage of natural refrigeration methods?
a) natural refrigeration methods are dependent on local conditions
b) natural refrigeration methods are not environment friendly
c) natural refrigeration methods are expensive
d) natural refrigeration methods are poisonous

8) Which of the following is the result of a reduction in operating pressure in the Air refrigeration cycle?
a) decrease in C.O.P.= b) always decreases **c) increase in C.O.P.** d) no change in C.O.P.

9) Which of the following is the key difference between a simple VAR and Electrolux refrigerator?
a) Working mechanism b) Generator c) Absorber **d) Liquid pump**

10. Efficiency of the Refrigerator is _____ to the C.O.P of the refrigerator.
a) independent b) directly proportional c) inversely proportional d) equal

11. Which of the following will be the value of Refrigeration effect if m_2 = 2 kg/min, m_3 = 0.8 kg/min and enthalpies for the refrigerant at saturated vapor and saturated liquid line are 1420 and 1260 kJ/kg?
a) 129 b) 196 c) 194 **d) 192**

12. Which of the following of the refrigerant is used as a refrigerant in Lithium Bromide Absorption Refrigeration system?
a) Lithium Bromide b) Hydrogen **c) Water** d) Ammonia

13. Which of the following refrigerants are used in Electrolux and Li-Br water refrigeration system?
a) Water and Bromide **b) Ammonia and Water** c) Ammonia and Lithium

d) Water and Water

14. Which of the following will be the value of Refrigeration effect if m_1 = 4 kg/min, and enthalpies for the point 1, 2, 4, 5, 9 are 1350, 1550, 1480, 1620, and 280 kJ/kg. If the refrigeration effect is 4280 kJ/min and work done is 15 kW, then what is the value of C.O.P.?
a) 4.75 b) 6.00 c) 5.50 d) 4.85

15. Which of the following is the common application of Air standard refrigeration system?
a) Cold storage
b) Car air conditioning system
c) Domestic refrigerators
d) Aircraft air conditioning

16. What is Air Conditioning?
a) Air Conditioning is the process of adding heat and increasing the humidity
closed

b) Air Conditioning is the process of removing heat and controlling the humidity of air in a space
c) Air conditioning is the process of controlling air moisture in an open area by adding heat
d) None of the mentioned

17. Which of the following process is used in winter air conditioning?
a) Cooling and Dehumidification
b) Heating and Humidification
c) Dehumidification
d) Humidification

18. On which of the following cycle the air conditioning systems are based in transport aviation?
a) Reversed Joule's cycle
b) Otto cycle
c) Reversed Carnot cycle
d) Reversed Brayton cycle

19. Which of the following process is used in summer air conditioning?
a) Heating and Humidification
b) Cooling and Dehumidification
c) Humidification
d) Dehumidification

20. If the Coefficient of performance of a heat pump is 5, then what is the value of the Coefficient of performance of the refrigerator operating under the same conditions?
a) 0.2
b) 3
c) 4
d) 6

21. How is the cascade system achieved?
a) VCR system in a parallel combination
b) VCR system in a series combination
c) VAR system in a series combination
d) VAR system in a parallel combination

22. Dense air Bell-Coleman refrigerator is preferred over open cycle air refrigerator.
a) False
b) True

23. In which of the following Capillary tube is used in as an expansion device?
a) Room air conditioners
b) Water coolers
c) Domestic refrigerators
d) All of the mentioned

24. Which of the following uses natural convection air-cooled condensers?
a) High capacity room air conditioners
b) Industrial air conditioners
c) Domestic refrigerators
d) High capacity water coolers

25. Which of the following is the material of tubes used for shell and tube condenser in ammonia **refrigeration** system?
a) Copper

b) Steel
c) Brass
d) Aluminum

26. Which of the following represents sensible cooling on the psychrometric chart?
a) Inclined line
b) Curve
c) Horizontal line
d) Vertical line

27. Which of the following is the major equipment in the simplest form is used to do saturation of air?
a) Pipe
b) Chamber
c) Vessel
d) Insulated Chamber

28. Why is the evaporator used?
a) To absorb heat
b) To decrease the refrigeration effect
c) To reject heat
d) To improve C.O.P.

29. Which of the following refrigerants is having the lowest C.O.P for refrigeration system working under the temperature limits of -15°C and 30°C as evaporator and condenser temperature respectively?
a) R – 12
b) Carbon dioxide
c) Ammonia
d) R – 30

30. Which of the following type of refrigerants take a direct part in the refrigeration system?
a) Primary
b) Secondary
c) Tertiary
d) Mixed

31). The temperature of the dry bulb _____ during the process of heating and dehumidification.

a. Increases

b. Decreases

c. Remains Constant

d. Cannot be Determined

32. A typical refrigeration cycle would operate between a +27°C condenser temperature and a -23°C evaporator temperature. Here, what would be the performance of the cycle's Carnot coefficient?

a. 6

b. 5

c. 1.2

d. 0.2

33). Which of these increases during the process of humidification?

a. Specific humidity

b. Dry bulb temperature

c. Relative humidity

d. Wet-bulb temperature

34). What does a vapour absorption refrigerator use in the form of a refrigerant?

a. Aqua-ammonia

b. Freon

c. Ammonia

d. Water

35). One ton of refrigeration in the S.J. unit is:

a. 840 kJ/min b. 420 kJ/unit c. 21 kJ/unit **d. 210 kJ/unit**

36). At a domestic refrigerator's back, the bank of tubes is known as:

a. Evaporator tubes **b. Condenser tubes** c. Capillary tubes d. Refrigerant cooling tubes

37). The expansion device, in any refrigeration system, is connected between:

a. Receiver and Condenser b. Compressor and Condenser

c. Compressor and Evaporator **d. Evaporator and Receiver**

38). What do we call the ratio of the actual mass of water present in an available volume of moist air to the total amount of water vapour present in the very same amount of saturated air present in the same pressure and temperature?

a. Degree of saturation b. Absolute humidity **c. Relative humidity** d. Humidity ratio

39). Which of these refrigerants is highly flammable and toxic?

a. R-12 b. Sulphur dioxide c. Carbon dioxide **d. Ammonia**

40). During the process of sensible heating of air, the wet-bulb temperature would be:

a. Decreases

b. Remains Constant

c. Increases

d. None of the above

41). What is the mixture of water vapour called when the maximum amount of water vapour has been diffused in the air?

a. Specific humidity **b. Saturated air** c. Moist air d. Dry air

42). In a vapour compression cycle, where do we find the lowest temperature?

a. Evaporator b. Condenser c. Expansion Valve d. Compressor

43). What is the pressure at a refrigerator's inlet known as?

a. Back Pressure b. Critical Pressure c. Discharge Pressure **d. Suction Pressure**

44). The ideal thermal efficiency of a reversible engine is 30%. The coefficient of performance, when we use it as a type of refrigerating machine with every other condition unchanged, will be:

a. 4.33 b. 3.33 **c. 2.33** d. 1.33

45). On the psychrometric chart, the marking of the alignment circle will be at:

a. 50% RH and 20°C DBT **b. 50% RH and 26°C DBT**

c. 60% RH and 20°C DBT d. 60% RH and 26°C DBT

46). Before entering the expansion or the throttle valve, a refrigerant's condition in any vapour compression system is:

a. Dry Vapour b. Very Wet Vapour

c**. High-Pressure Saturated Liquid** d. Moist Vapour

47). Which of these types of compressors are used in our domestic refrigerators?

a. Axial b. Centrifugal **c. Piston Type Reciprocating** d. Miniature Sealed Unit

48). Which of these is the refrigerant that has the highest critical pressure?

a. R-12 **b. Ammonia** c. R-11 d. R-22

49) The instruments pyrometer used for the measurements of ---

a. high temperature b. pressure c. volume d. entropy

50) In a refrigeration cycle, heat is rejected by the refrigerant in a

(a) expansion valve
(b) condenser
(c) compressor
(d) evaporator