FY B VOC REFRIGERATION AND AIR CONDITIONING

SUBJECT: Basics of Air Conditioning SEM I

Notes for IN SEM Examination

Que 1 Multiple choice Questions (Unit 1 & Unit 2)

Que No	Question	Correct Answer
1.	At 100% Relative Humidity, WBT,DBT,DPT are A. Different B. Equal C Any Two are equal D None of above	B
2.	The temperature of the dry bulb _____ during the process of heating and dehumidification. a. Increases b. Decreases c. Remains Constant d. Cannot be Determined	A
3.	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	B
4.	For a winter air-conditioning system, relative humidity should NOT be more than: A 60% B 75% C 40 % D 90%	C
5.	The arc (pressure) of saturated water vapor is called A Vapor Pressure B Page Stress C Absolute Arc D Partial Arc (Pressure)	A
6.	Mixture of dry air and water vapor is _____ a) moist air b) dry air c) fresh air d) saturated air	A

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7.	What is the mass of water vapor present in 1 kg of dry air called? a) Specific Humidity b) Relative humidity c) Degree of saturation d) Saturated air	A
8.	What is the ratio of actual mass of water vapor in a given volume of moist air to the mass of water vapor in the same volume of saturated air at the same pressure and temperature? a) Specific Humidity b) Relative humidity c) Degree of saturation d) Saturated air	B
9.	What is the temperature of air recorded by a thermometer, when the moisture present in it starts condensing? a) DBT b) WBT c) DPT d) WBD	C
10.	What is the difference between DBT and WBT called? a) DPD b) DBD c) Degree of saturation d) WBD	D

Unit 1_ Theory Questions

Q 1	State Dalton's Law of Partial Pressure. **Answer**: Dalton's Law of Partial Pressure states that in a mixture of non-reacting gases, the total pressure exerted by the mixture is the sum of the partial pressures exerted by each individual gas. Mathematically, Ptotal=P1+P2+P3+…$P_{total}=P_1+P_2+P_3+\dots$ where P1,P2,P3,…$P_1,P_2,P_3,\dots$ are the partial pressures of the individual gases.
Q 2	**What is the difference between dry and wet bulb temperatures?** **Answer**:

	Dry bulb temperature (DBT) is the temperature of air measured by a standard thermometer exposed to the air but not affected by evaporation. **Wet bulb temperature (WBT)** is the temperature measured by a thermometer with its bulb covered by a wet wick and exposed to air. It reflects both the temperature and the amount of moisture in the air, as evaporation of the water from the wick causes cooling.
Q 3	**What is wet bulb depression?** **Answer**: Wet bulb depression is the difference between the dry bulb temperature and the wet bulb temperature. It represents the amount of cooling that occurs due to evaporation and is a measure of the humidity in the air. Wet bulb depression=TDB−TWB Wet bulb depression=$T_{DB}-T_{WB}$ **What is the dew point?** **Answer**: The **dew point** is the temperature at which air becomes saturated with moisture, and water vapor begins to condense into liquid water. It is an indicator of the moisture content in the air—higher dew points indicate higher humidity levels. **What is dew point depression?** **Answer**: Dew point depression is the difference between the dry bulb temperature and the dew point temperature. It provides a measure of the humidity level in the air. The larger the dew point depression, the drier the air, and the smaller the depression, the more humid the air.
Q 4	**What is wet bulb depression? Explain its significance in psychrometry and its relationship with humidity levels in the air.** **Wet Bulb Depression: Definition and Explanation** **Wet bulb depression** is the difference between the **dry bulb temperature (DBT)** and the **wet bulb temperature (WBT)** in a given air sample. It represents the amount of cooling that occurs when water evaporates from the wet wick of a thermometer (the wet bulb), which is exposed to the air. Mathematically, it is given by:

	Wet Bulb Depression=$T_{DB}-T_{WB}$ Where: TDB T_{DB} is the dry bulb temperature (the regular air temperature measured by a thermometer). TWB T_{WB} is the wet bulb temperature (the temperature measured by a thermometer with its bulb covered by a wet wick). **Significance of Wet Bulb Depression in Psychrometry** In psychrometry, wet bulb depression is a key parameter because it directly reflects the **humidity level** of the air. The significance can be broken down as follows: **Indicator of Humidity**: The **larger the wet bulb depression**, the **drier the air**. This is because dry air allows more water to evaporate, causing a greater cooling effect. The **smaller the wet bulb depression**, the **higher the humidity** in the air. If the air is near saturation, there is little evaporation, and the wet bulb temperature will be close to the dry bulb temperature. **Relationship with Relative Humidity**: Wet bulb depression is inversely related to **relative humidity**. High relative humidity means that the air is already holding a large amount of moisture, so evaporation is less effective, and the wet bulb depression will be smaller. Conversely, low relative humidity means the air can absorb more water, and the wet bulb depression will be larger.
Q 5	**HOW IS dew point depression used to evaluate the moisture content of the air** Dew point depression is the difference between the dry bulb temperature (DBT) and the dew point temperature (DPT) of the air. It serves as an indicator of the air's moisture content: a small dew point depression (where DBT and DPT are close) suggests high humidity and a high moisture content in the air, while a large dew point depression indicates low humidity and dry air. By assessing the dew point depression, we can evaluate how close the air is to saturation, which helps in determining the need for humidification or dehumidification in HVAC systems and other applications.

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Unit 2_ Theory Questions

Q 1	**What is Specific Humidity, and how is it calculated?** **Answer**: Specific humidity is the mass of water vapor per unit mass of dry air. It is a measure of the moisture content of the air and is expressed in units of grams of water vapor per kilogram of dry air (g/kg). Specific humidity (ω) is calculated using the formula: $\omega = m_a m_v$ Where: m_v is the mass of water vapor. m_a is the mass of dry air. Specific humidity is independent of temperature and pressure and is useful in calculating other air properties, such as the mixing ratio or humidity ratio.
Q 2	**What is Degree of Saturation, and how is it related to humidity?** Answer**: The** degree of saturation **refers to the ratio of the actual amount of water vapor present in the air to the maximum amount of water vapor the air can hold at a specific temperature. It is expressed as a percentage:** $$\text{Degree of Saturation} = \left(\frac{\text{Actual Water Vapor}}{\text{Saturated Water Vapor at Temperature}} \right) \times 100$$ **When the degree of saturation is 100%, the air is fully saturated, and condensation begins to occur. The degree of saturation indicates how close the air is to reaching its maximum moisture capacity and helps determine** relative humidity**.**
Q 3	**Explain Relative Humidity and its significance in psychrometry.** **Answer**: **Relative humidity** (RH) is the ratio of the current amount of water vapor in the air to the maximum amount of water vapor the air can hold at a given temperature, expressed as a percentage. The formula is:

	$$RH = \left(\frac{\text{Actual Water Vapor}}{\text{Saturated Water Vapor}} \right) \times 100$$ Relative humidity is important because it directly affects comfort, condensation, and various industrial processes. At 100% RH, the air is fully saturated, and condensation will occur. Low RH indicates dry air, which may cause discomfort, dehydration, and static electricity.
Q 4	**What is Humid Specific Heat, and why is it important in thermodynamics?** **Answer**: **Humid specific heat** is the amount of heat required to raise the temperature of a unit mass of moist air by one degree Celsius. It accounts for both the specific heat of dry air and the latent heat of water vapor. The humid specific heat (CphC_{ph}) is calculated as: Cph=Cpa+ωCpv Where: Cpa is the specific heat of dry air. Cpv is the specific heat of water vapor. ω is the specific humidity. Humid specific heat is crucial in determining energy requirements for heating or cooling moist air in systems like air conditioning and ventilation, as it affects how much energy is needed to change the air's temperature.
Q 5	**What is Enthalpy of Moist Air, and how is it used in HVAC systems?** **Answer**: The **enthalpy of moist air** is the total heat content of a unit mass of moist air, including the sensible and latent heat. It is important for understanding the energy balance in heating, cooling, or humidification processes. The formula for enthalpy hh of moist air is: h=CpaT+ω(hfg+CpvT) Where: T is the temperature of the air. hfg is the latent heat of vaporization of water. Cpa and Cpv are the specific heats of dry air and water vapor, respectively. Enthalpy is used in HVAC systems to calculate energy requirements for conditioning air. It helps determine how much energy is needed to change the temperature or moisture content of the air in spaces like buildings or industrial processes.