Fall'03
1.044J, 2.45J, 4.42J
Homework Set #5

FOR ALL OF THE FOLLOWING PROBLEMS USE THE PSYCHOMETRIC CHARTS WHEN YOU CAN TO OBTAIN THE NEEDED DATA.

1. The air leaving an office space is at 78^{o}F dry bulb and 85% relative humidity. The leaving air is cooled to 65^{o}F dry bulb and 70% relative humidity and returned to the office space. This is accomplished by first sensible cooling of the air to saturation, then cooling and dehumidification along the saturation line and finally reheating without vapor addition. Show the process on the psychometric curve. Find the energy requirement for each of the three processes per pound of dry air.

2. The overall change of state described in problem 1 is to be accomplished solely by mixing the leaving air with cool air at 55^{o}F. What must the relative humidity of the cool air be so that the mixture can reach the 65^{o}F dry bulb and 70% relative humidity state? How many pounds of cool air are needed per pound of leaving air?

3. A building in the Southwest is to be cooled by use of an evaporative cooler. Cool liquid water is sprayed into outside air as it is brought into the building. The outside air is at 90^{o}F dry bulb temperature and 10% relative humidity. Show the cooling process on a psychometric chart assuming the enthalpy of the liquid water is negligible in the energy balance. How much water must be evaporated for each 10^{o}F dry bulb temperature decrease of the air?

3b. Steam, hot water vapor, is mixed with the outside air. Show the process on the psychometric chart when the enthalpy of the steam, enthalpy per mass of steam, is equal to the enthalpy of the water vapor in the outside air at 90 ^{o}F, 10% RH. What happens when the steam enthalpy is greater than the enthalpy of the water vapor in the outside air?

4. Within the building considered in problem 3 the sensible heat gain is twice the latent heat gain. If the air conditions within the office space (well mixed conditions) is 80^{o}F and 40% relative humidity, construct the condition line for the building. The condition line is the line on the psychometric chart representing all of the possible states of the supply air which yields the desired well mixed conditions within the building. The indoor conditions are maintained by mixing the ambient air, cooled by evaporation as given in problem 3, with the exhaust from the building. What is the only state of the cooled ambient air which permits the interior conditions to be maintained, i.e. for the specified state of the interior air and the given ratio of sensible to latent heat gain?