

INSTRUCTIONS:

For any problems labeled with 'E' in the problem, use EES to solve the problem. You are welcome to use EES for problems without an 'E' as well.

Submit all assignments as **PDF** to **Canvas**. Please do not submit ZIP files.

Follow the [EES Formatting Guide](#) to generate solutions to the below problems.

DO NOT FORGET TO SOLVE PRIOR TO PRINTING TO PDF!

Problem 1:

Use the psychrometric chart given on canvas to determine the specific humidity ω , the enthalpy h , the wet-bulb temperature T_{wb} , the dew-point temperature T_{dp} , and the specific volume of the dry air v . Assume that the outside air temperature is 38°C with a relative humidity $\phi = 40\%$.

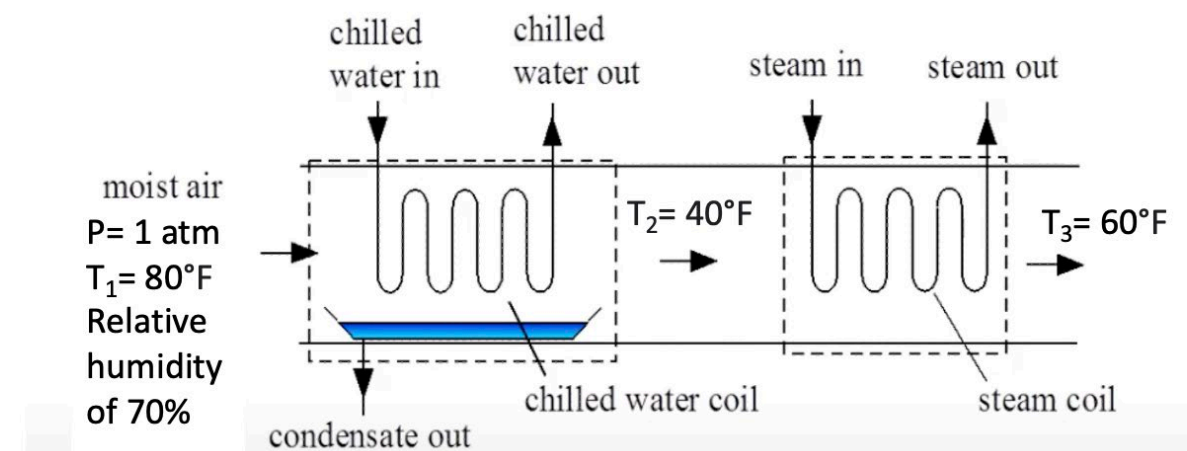
Problem 3E: Using EES

Given: Moist air at 1 atm, 80°F and 60% relative humidity.

Find the following psychrometric properties of the mixture:

- I. Humidity ratio
- II. Specific enthalpy
- III. Specific volume
- IV. Wet bulb temperature
- V. Dew point temperature

Problem 3E: Using EES



Find:

- I. Mass flow rate of dry air entering
- II. Dew point temperature
- III. Mass flow rate of condensate
- IV. Volumetric flow rate of condensate
- V. Rate of heat transfer to the chilled water coil

Problem 4. A simple air-handling unit (AHU) contains dampers that allow mixing of outdoor air (ODA) and return air (RA), a fan, and a cooling coil (CC). This piece of equipment, shown in Figure 1, is commonly used to provide cooling to buildings; a heating coil may also be present, depending on the system design. Figure 1 Air handling unit used for cooling of buildings This AHU has the following characteristics and operating conditions for this problem.

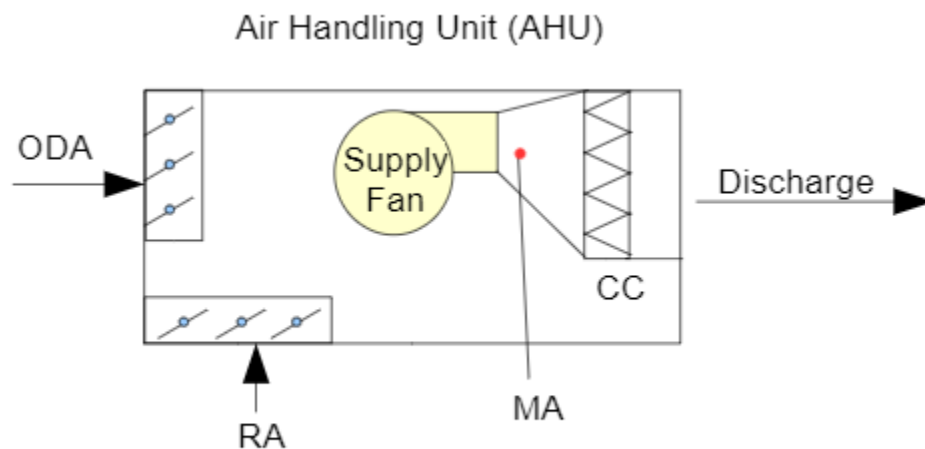


Figure 1 Air handling unit used for cooling of buildings

- 600 CFM of ODA at 80°F, 70°F WBT
- 1200 CFM of RA at 65°F, 30% RH
- Discharge is at 50°F, 45°F WBT
- The fan has a small heat output, which we will neglect for this homework.

Find the following, using the psychrometric chart:

- a. Mass flow rate, relative humidity, enthalpy, and humidity ratio of ODA.
- b. Mass flow rate, wet bulb temperature, enthalpy, and humidity ratio of RA.
- c. Mass flow rate, wet bulb temperature, enthalpy, and humidity ratio of MA (mixed air).
- d. Mass flow rate, humidity ratio, enthalpy, and relative humidity of discharge air.
- e. Sensible heat transfer rate of cooling coil i.e. sensible cooling provided, in Btu/hr.
- f. Latent heat transfer rate of cooling coil. i.e. latent cooling provided, in Btu/hr. g. Mass flow rate (lb/hr) of condensate.

- g. Provide a clearly labeled psychrometric chart; label the points ODA, RA, MA, DA (for discharge air); show the process lines for mixing and the cooling coil.

Problem 5E: **Using EES**

Solve problem 4 using EES. Plot the psychrometric process on a chart using EES.