FAQs

I. A sample of air has a dry bulb temperature of 35◦C and a wet bulb temperature of 30◦C. Using a psychrometric chart, determine the absolute humidity, percentage saturation, dew point and specific volume of the air. The point representing the sample is located at the intersection of a vertical line from T = 35◦C on the dry bulb temperature axis with a line representing Tw = 30◦C. From this point the following values can be read:

Solution:

H = 0.026 kg kg−1

Percentage saturation = 68%

Dew point = 28.5◦C

Specific volume = 0.908 m3 kg−1

II. Air, originally at 40◦C and 10% saturation, is cooled adiabatically by contacting it with water, which is at the wet bulb temperature of the gas. What is the lowest temperature to which the air may be cooled and how much water is vaporised per kilogram of dry air in reaching this temperature?

Solution:

The lowest temperature to which the air may be cooled is the wet bulb temperature of the air, that is, 19◦C. At this point the air is saturated and the mass of water vaporised per kg of dry air is equal to the difference in humidity which equals (0.0138−0.0049) kg kg−1 or 0.0089 kg water per kg of dry air.

III. Air at 30°C and 10% relative humidity enters an evaporative cooler where moisture is evaporated until the temperature reaches 21°C. What is the relative humidity of the air as it leaves?

Solution:

The initial conditions (at t1 = 30°C and φ 1 = 10%) are (using Figure 9.01):

t_{wb} = 13.3°C

h1 = 37 kJ/kg dry air

w1 = 2.6 g/kg dry air

This method of moisture addition is a constant wet-bulb process. By following a constant wet-bulb line to t2 = 21°C, we find:

φ_2 = 41%

IV. Steam is added to air at 30°C and 10% relative humidity until the temperature reaches 38°C and the humidity ratio (W) is 18 g water/kg dry air. How much water is added to one kilogram of air?

Solution:

This process does not follow a constant property line. Instead, we define state point one (Example 9.1) and state point two from the given information. Thus, state point two has the following properties:

t_2 = 38°C (given)

W_2 = 18 g/kg dry air (given)

φ_2 = 43%

t_{wb} = 26.9°C

t_{dp} = 23.2°C

h_2 = 84.5 kJ/kg dry air

The moisture added is

$W_2 - W_1 = 18 - 2.6 = 15.4$g/kg dry air