مصرح باستخدام جداول وخرائط ومعادلات إنتقال الحرارة والكتلة وخرائط الهواء الرطب
تقرب الأجابة الى أقرب رقمين عشريين:

Question 1:

1- What is the difference between the drying and evaporation processes?

2- Mark these statements as being True or False for a binary mixture of substances A and B.

(*a*) The ratio of the density of component A to the density of component B is equal to the mass fraction of component A.

(*b*) If the mass fraction of component A is greater than 0.5, then at least half of the moles of the mixture are component A.

(*c*) If the mass fractions of A and B are both 0.5, then the molar mass of the mixture is simply the arithmetic average of the molar masses of A and B.

(*d*) The ratio of the molar concentration of A to the molar concentration of B is equal to the mole fraction of component A.

(*e*) If the mole fraction of component A is greater than 0.5, then at least half of the mass of the mixture is component A.

3- How does the mass diffusivity of a gas mixture change with (*a*) temperature and (*b*) pressure?

4- Consider a 5-m x 5-m wet concrete patio with an average water film thickness of 0.3 mm. Now wind at 50 km/h is blowing over the surface. If the air is at 1 atm, 15°C, and 35 percent relative humidity, determine how long it will take for the patio to dry completely.

Question 2:

1- At a given temperature and pressure, do you think the mass diffusivity of copper in aluminum will be equal to the mass diffusivity of aluminum in copper? Explain.

2- Give examples for different kinds of diffusion processes and mention the difference between them:

       (a) Liquid-to-gas,
       (b) Solid-to- liquid,
       (c) Solid-to-gas, and
       (d) Gas-to-liquid mass transfer.

3- Using the Chilton-Colburn equation, prove that the surface temperature of the wet body can be expressed as:

$$T_s = T_\infty - \frac{h_{fg}}{C_p Le^{2/3}} \frac{M_v}{M} \frac{P_{v,s} - P_{v,\infty}}{P}$$

4- One way of increasing heat transfer from the head on a hot summer day is to wet it. This is especially effective in windy weather, as you may have noticed. Approximating the head as a 30-cm-diameter sphere at 30°C with an emissivity of 0.95, determine the total rate of heat loss from the head at ambient air conditions of 1 atm, 25°C, 40 percent relative humidity, and 25 km/h winds if the head is (*a*) dry and (*b*) wet. Take the surrounding temperature to be 25°C.

Question 3:

1- What is the physical significance of the Schmidt number? How is it defined? To what dimensionless number does it correspond in heat transfer? What does a Schmidt number of 1 indicate?

2- Does a mass transfer process have to involve heat transfer? Describe a process that involves both heat and mass transfer.

3- A gas mixture consists of 5 Kg of O_2, 8 Kg of N_2, and 10 Kg of CO_2. Determine (*a*) the mass fraction of each component, (*b*) the mole fraction of each component, and (*c*) the average molar mass of the mixture.

4- The diffusion coefficient of carbon in steel is given as: $D_{AB} = 2.67 \times 10^{-5} \exp(-17,400/T)$ m^2/s where T is in K. Determine the diffusion coefficient from 300 K to 1500 K in 100 K increments and plots the results.