淡江大學九十學年度日間部轉學生招生考試試題

系別：化學工程學系三年級

科目：質 能 均 衡

准帶項目請打「○」否則打「×」	
計 算 機	字 典
○	○

本試題共 兩 頁

本試題雙面印製

1. A catalytic reactor is used to produce formaldehyde from methanol in the reaction

$$CH_3OH \rightarrow HCHO + H_2$$

A single-pass conversion of 60.0% is achieved in the reactor. The methanol in the reactor product is separated from the formaldehyde and hydrogen in a multiple-unit process. The production rate of formaldehyde is 900.0 kg/h.

(a) Calculate the required feed rate of methanol to the process (kmol/h) if there is no recycle. (15%)

(b) Suppose the recovered methanol is recycled to the reactor and the single-pass conversion remains 60.0%. Without doing any calculations, prove that you have enough information to determine the required fresh feed rate of methanol (kmol/h) and the rates (kmol/h) at which methanol enters and leaves the reactor. Then perform the calculations. (10%)

2. Saturated steam at $100^\circ C$ is heated to $400^\circ C$. Determine (a) the required heat input (J/s) if a continuous stream flowing at 100 kg/s undergoes the process at constant pressure and (b) the required heat input (J) if 100 kg undergoes the process in a constant-volume container. What is the physical significant of the difference between the numerical values of these two quantities? (25%)

$\hat{H}(400^\circ C, 1\,atm) = 3278\,kJ/kg$, $\hat{H}(100^\circ C, 1\,atm) = 2676\,kJ/kg$

$\hat{U}(400^\circ C, 1\,atm) = 2968\,kJ/kg$, $\hat{U}(100^\circ C, 1\,atm) = 2507\,kJ/kg$

3. The latest weather report states that temperature is $24^\circ C$ and the relative humidity is 50%.

(a) Use the psychrometric chart to estimate the absolute humidity, humid volume, specific enthalpy, wet-bulb temperature, and dew-point temperature of the air. (10%)

(b) A thermometer is mounted on the back porch of your house. What temperature would it read? (10%)

(c) A sample of outside air is cooled at constant pressure. At what temperature would condensation begin? (5%)

◀注意背面尚有試題▶

淡江大學九十學年度日間部轉學生招生考試試題

系別：化學工程學系三年級

科目：質 能 均 衡

准帶項目請打「○」否則打「×」	
計 算 機	字 典
○	○

本試題共 兩 頁

4. Humid air is enclosed in a 2.00-liter flask at $40^{\circ}C$. The flask is slowly cooled. When the temperature reaches $20^{\circ}C$, drops of moisture become visible on the flask wall. Use the psychrometric chart to solve the following problems.
   (a) What were the relative humidity, absolute humidity, and wet-bulb temperature of the air at $40^{\circ}C$? (15%)
   (b) Calculate the mass of the water in the flask? (10%)

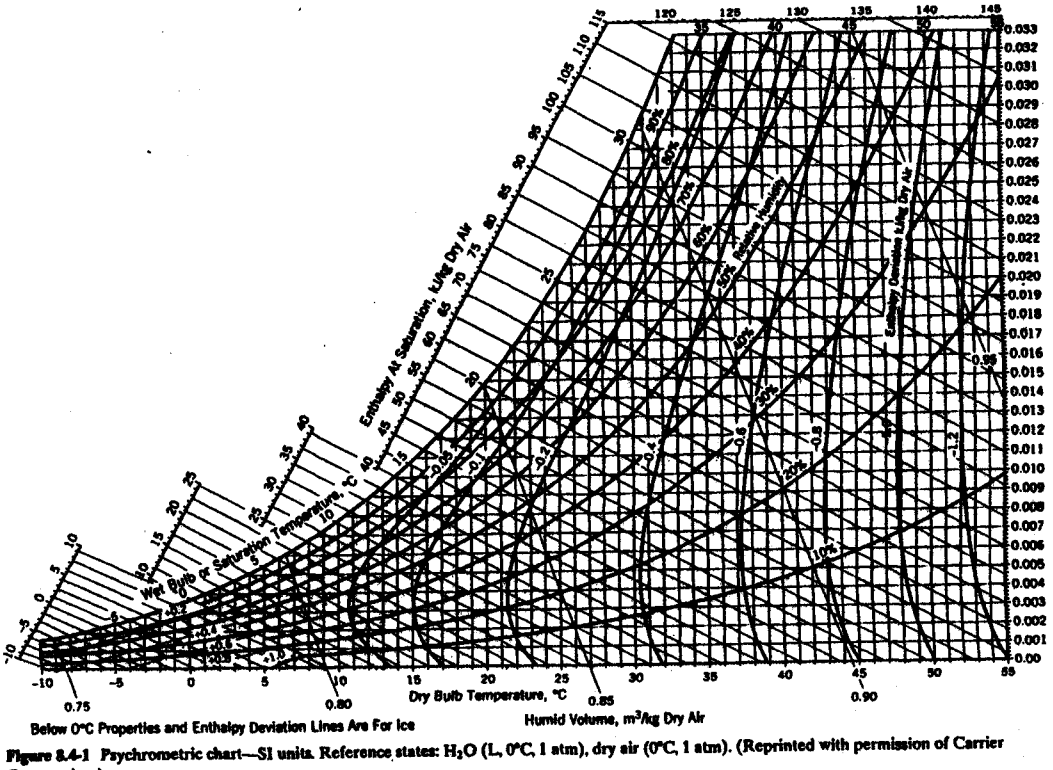

Figure 8.4-1 Psychrometric chart—SI units. Reference states: H_2O (L, 0°C, 1 atm), dry air (0°C, 1 atm). (Reprinted with permission of Carrier Corporation.)