

# 淡江大學 107 學年度日間部轉學生招生考試試題

系別：化學工程與材料工程學系  
三年級

科目：質能均衡

29-1

考試日期：7月24日(星期三) 第1節

本試題共 5 大題， 2 頁

本試題雙面印刷

1. Two formulas for the heat capacity of CO are given below: (15 %)

$$C_p(\text{cal/g-mol}\cdot^\circ\text{C}) = 6.890 + 0.001436 \cdot T(^\circ\text{C})$$

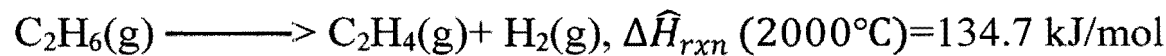
$$C_p(\text{Btu/lb-mol}\cdot^\circ\text{F}) = A + B \cdot T(^\circ\text{F}), \text{ where } A, B \text{ are constants.}$$

Starting with the first formula, derive the second and calculate A and B.

(Given: Btu = 252 cal, lb = 453.6 g)

2. Ethane is initially mixed with oxygen to obtain a gas containing 80% C<sub>2</sub>H<sub>6</sub> and 20% O<sub>2</sub> that is then burned with 200 % excess air. Eighty percent of ethane goes to CO<sub>2</sub>, 10% goes to CO, and 10% retains unburned. Calculate the composition of the exhaust gas on a wet basis. (20 %)

3. Ethylene is made commercially by dehydrogenating ethane. (20 %)



Ethane is fed to a continuous adiabatic reactor at  $T_0 = 2000^\circ\text{C}$ .

Calculate the exit temperature that would correspond to complete conversion. Use the following heat capacities in your calculations:

for C<sub>2</sub>H<sub>4</sub>,  $C_p = 40.75 + 0.1147 \cdot T(^\circ\text{C});$

for H<sub>2</sub>,  $C_p = 28.04 + 4.167 \cdot 10^{-3} T(^\circ\text{C});$  (J/mol·°C)

for C<sub>2</sub>H<sub>6</sub>,  $C_p = 49.37 + 0.1392 \cdot T(^\circ\text{C}).$

4. In a process for the preparation of methyl iodide, 2000 kg/day of hydroiodic acid is added to an excess of methanol: (25 %)

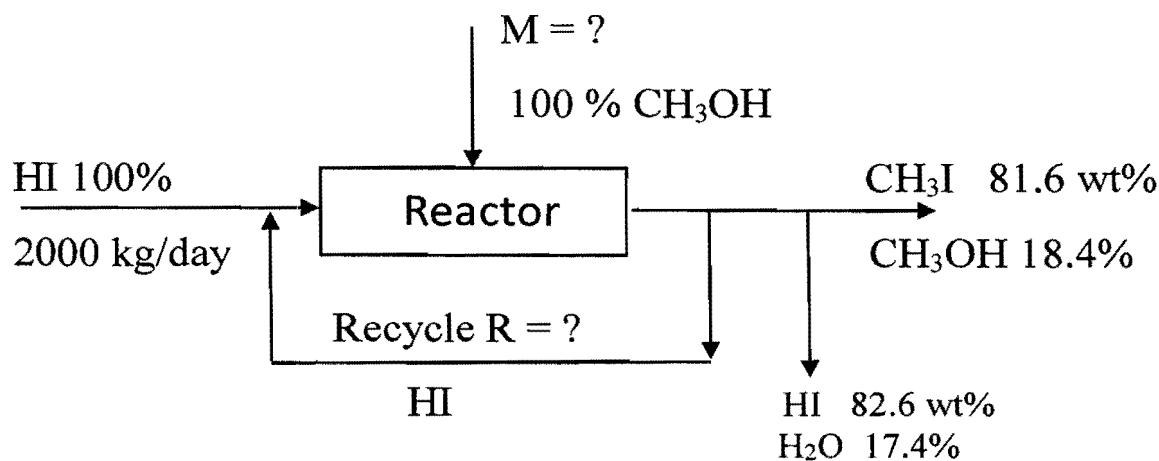


If the product contains 81.6 wt% CH<sub>3</sub>I along with the unreacted methanol, and the waste contains 82.6 wt% hydroiodic acid and 17.4% H<sub>2</sub>O, calculate, assuming that the reaction is 40% complete:

(a) the *weight of methanol added (M)* per day, and

(b) the *amount of HI recycled (R)*.

(Given atomic weight: I = 127, H = 1, O = 16, C = 12)



背面尚有試題

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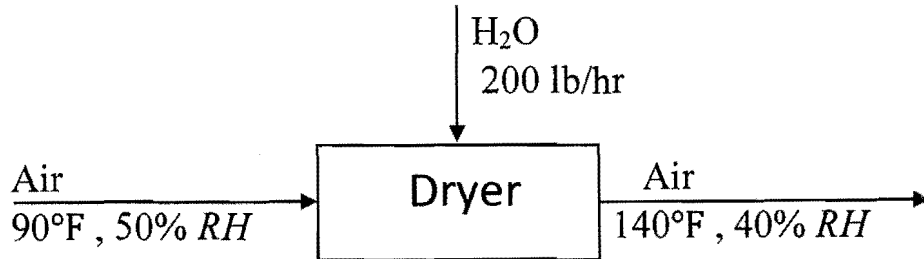
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29-2

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5. A dryer must evaporate 200 lb/hr of  $H_2O$ . Air at  $90^\circ F$  and 50% RH (relative humidity) enters the dryer, leaving at  $140^\circ F$  and 40% RH. What volume of  $90^\circ F$  air is necessary per hour? (20%)



(Hint: You may make mass balance calculations around the dryer.)

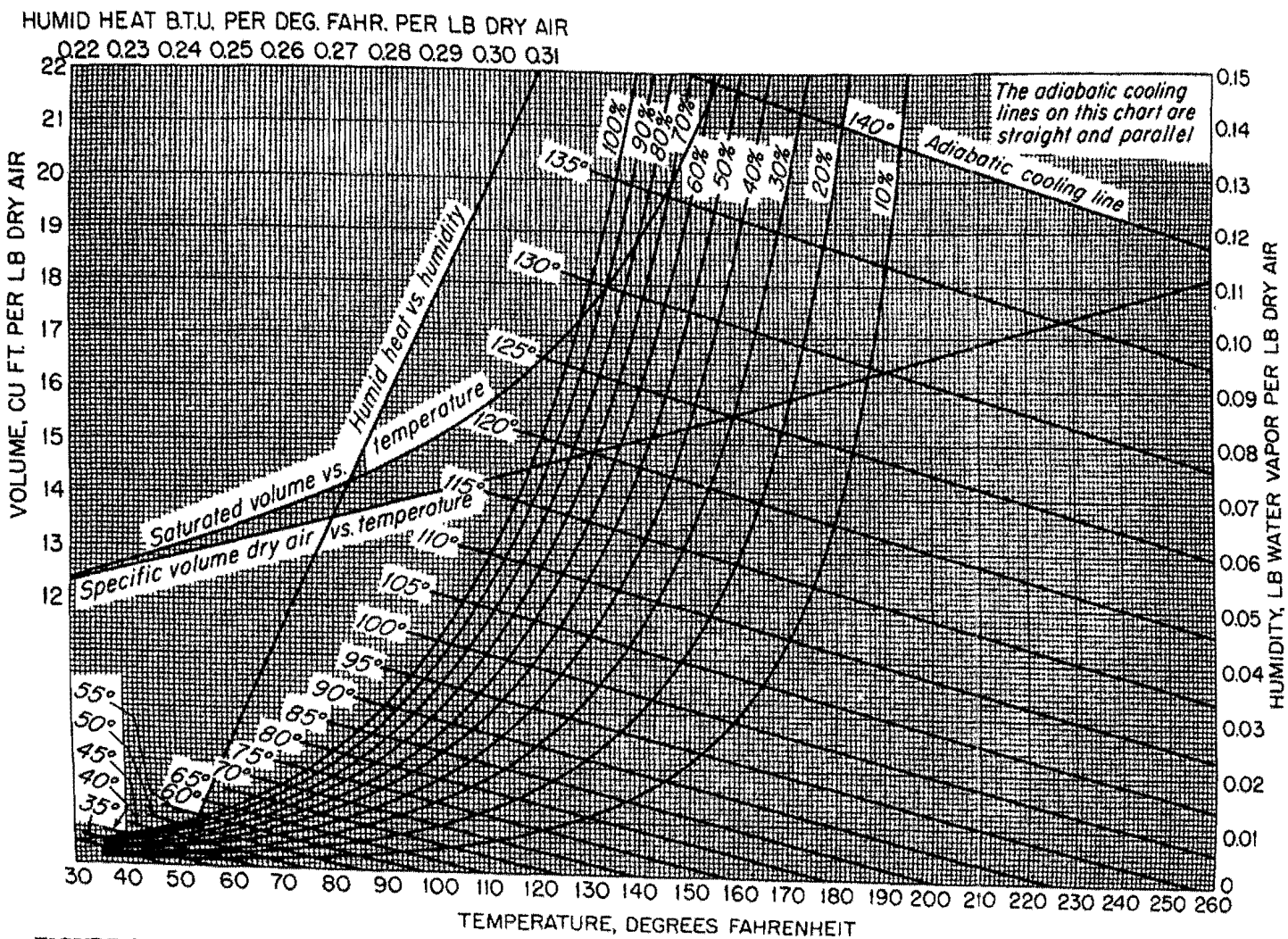


FIGURE 23.2  
Humidity chart. Air-water at 1 atm.