

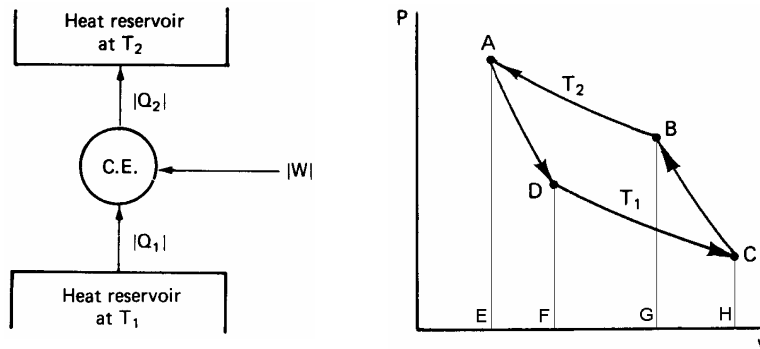
義守大學 102 學年度碩士班入學招生考試試題

系所別	生物技術與化學工程研究所	考試日期	102/3/16
考試科目	反應工程與化工熱力學	頁碼/總頁數	1/2

※此為試題卷，請將答案填寫在答案卷內，未寫於答案卷內者，不予計分。

※本科目可使用計算機。

- 7 kmol of an ideal gas ($c_p = 30 \text{ kJ/kmol}\cdot\text{K}$) originally at 400 K and 3 bar is compressed adiabatically and irreversibly to 600 K and 5 bar. Find (1) ΔU (change of internal energy), (2) ΔH (change of enthalpy), and (3) W (work received by the ideal gas). (15 points)
- For a Carnot engine operating in reverse (i.e., heat pump), as shown in the following figure, (1) what area represents $|Q_1|$? (2) what area represents $|Q_2|$? and (3) what area represents the work received by the engine per cycle? (15 points)



- The ΔH for the following change in state is $+453 \text{ cal/mol}$ at 298 K;
 carbon (graphite, 1 atm) \rightarrow carbon (diamond, 1 atm)
 Estimate ΔH for the change of state at 500K. The average heat capacities for graphite and diamond are 2.99 and 2.57 cal/mol-K, respectively. Be sure to outline the computational path. (15 points)
- A two-phase, two component system is composed of furan (1) and carbon tetrachloride (2). At 30°C and 600 mmHg, the equilibrium compositions are $x_1 = 0.77$ and $y_1 = 0.92$. The vapor pressure for furan at 30°C is 715 mmHg, and for carbon tetrachloride, 172 mmHg. Estimate the activity coefficients, γ_1 and γ_2 , under this condition. (15 points)
- One liter/min of liquid containing D and E ($C_{D0} = 0.10 \text{ mol/liter}$, $C_{E0} = 0.01 \text{ mol/liter}$) flow into a mixed reactor of volume $V = 1 \text{ liter}$. The reaction stoichiometry is unknown. The outlet stream from the reactor contains D, E, and F ($C_{Df} = 0.02 \text{ mol/liter}$, $C_{Ef} = 0.03 \text{ mol/liter}$, $C_{Ff} = 0.04 \text{ mol/liter}$). Find the rate of reaction of D, E, and F for the conditions in the reactor. (10 points)

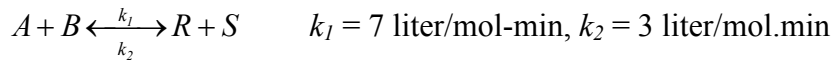
義守大學 102 學年度碩士班入學招生考試試題

系所別	生物技術與化學工程研究所	考試日期	102/3/16
考試科目	反應工程與化工熱力學	頁碼/總頁數	2/2

※此為試題卷，請將答案填寫在答案卷內，未寫於答案卷內者，不予計分。

※本科目可使用計算機。

6. The liquid-phase reaction



is to take place in a 120-liter steady-state mixed reactor. Two feed streams, one containing 2.8 mol A/liter and the other containing 1.6 mol B/liter, are to be introduced in equal volumes into the reactor, and 75% conversion of component B is desired. What should be the flow rate of each stream? Assume a constant density for the reaction. (20 points)

7. A reactor setup consists of three plug flow reactors in two parallel branches, branch A and branch B. Branch A has a reactor volume 50 liters followed by a reactor of volume 30 liters. Branch B has a reactor of volume 40 liters. What fraction of the feed should go to branch A. (10 points)