明新科技大學九十五學年度研究所 ☑ 碩 士 班 ☐ 碩士在職專班 招生考試試題卷

所別	科目	准考證號碼(請考生填入)	考試日期	節次	第1頁/共2頁
化學工程研究所	化工熱力學與化工動力學		95年5月7日	第二節	

一、 After 3 minutes in a batch reactor, reactant (C_{A0}=1 mol/liter) is 60% converted； After 8 minutes, conversion is 80%. Find a rate equation to represent this reaction.. (20%)
(Hint: you can try this reaction is zero, first or second order)

二、 Derive the equation (1), the rate law for the decomposition of C_2H_6 ($C_2H_6 \rightarrow C_2H_4 + H_2$)

$$d(C_2H_4)/dt = \mathbf{k_3}\left(\frac{\mathbf{k_1}}{\mathbf{k_5}}\right)^{1/2}(C_2H_6)^{1/2} \quad \text{-------} \quad (1)$$ (20%)

The mechanism of decomposition of C_2H_6 is ：

$$C_2H_6 \xrightarrow{k_1} 2CH_3\cdot$$

$$CH_3\cdot + C_2H_6 \xrightarrow{k_2} CH_4 + C_2H_5\cdot$$

$$C_2H_5\cdot \xrightarrow{k_3} C_2H_4 + H\cdot$$

$$H\cdot + C_2H_6 \xrightarrow{k_4} H_2 + C_2H_5\cdot$$

$$2\,C_2H_5\cdot \xrightarrow{k_5} C_4H_{10}$$

(Hint：Using the steady-state approximation method)

三、 Enzyme E catalyses the fermentation of substrate A(the reactant) to product R. Find the size of mixed flow reactor needed for 95% conversion of reactant in a feed stream (25 liter/min) of reactant (2 mol/liter) and enzyme. The kinetics of the fermentation at this enzyme concentration are given by

$$A \xrightarrow{\text{enzyme}} R \qquad -r_A = \frac{\mathbf{0.2C_A}}{\mathbf{1+0.4C_A}} \text{ mol/liter}\cdot\text{min}$$ (20%)

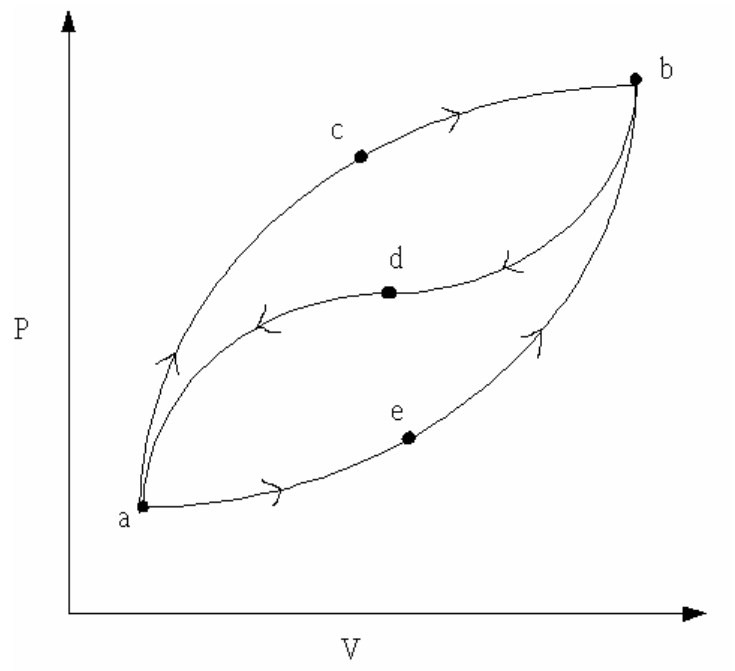
四、 When a system is taken from state a to b as shown in the following figure along the path acb, 150 J of heat flows into the system and the system does 50 J of work. (20%)

(a) How much heat flows into the system along path aeb if the work done by the system is 30 J ?

(b) The system returns from b to a along path bda. If the work done on the system is 40 J, does the system absorb or liberate heat? How much ?

明新科技大學九十五學年度研究所 ☑ 碩 士 班 ☐ 碩士在職專班 招生考試試題卷

所別	科目	准考證號碼(請考生填入)	考試日期	節次	第2頁/共2頁
化學工程研究所	化工熱力學與化工動力學		95年5月7日	第二節	



五、 From functional relations of U=U(T,V) and S=S(T,V), Please show that

$$\mathbf{dU = C_V dT + [T(\frac{\partial P}{\partial T})_V - P]dV} \quad \text{and} \quad \mathbf{dS = \frac{C_V}{T} dT + (\frac{\partial P}{\partial T})_V dV} \qquad (20\%)$$