

國立高雄大學九十七學年度研究所碩士班招生考試試題

科目：

化工熱力學與化學反應工程

考試時間：100 分鐘

系所：

化學工程及材料工程學系碩士班甲組

本科原始成績：100 分

是否使用計算機：是

1. An engineer claims to have invented a steady-flow device that will take air at 4 bar and 20°C and separate it into two streams of equal mass, one at 1 bar and -20°C and the second at 1 bar and 60°C. Furthermore, the inventor states that his device operates adiabatically and does not require (or produce) work. Is such a device possible? (Air can be assumed to be an ideal gas with a constant heat capacity of $C_p = 29.3 \text{ J/mol K}$.) (12%)



2. The enthalpy of a binary liquid system of species 1 and 2 at fixed temperature and pressure is represented by the equation:

$$H = 400x_1 + 600x_2 + x_1x_2(40x_1 + 20x_2)$$

where H is in J mol^{-1} . Determine expressions for \overline{H}_1 and \overline{H}_2 as functions of x_1 , numerical values for the pure species enthalpies H_1 and H_2 , and numerical values for the partial enthalpies at infinite dilution \overline{H}_1^∞ and \overline{H}_2^∞ . (24%)

3. An ideal gas undergoes the following sequence of mechanically reversible process in a closed system:

- (a) From an initial state of 70°C and 1 bar, it is compressed adiabatically to 150°C.
- (b) It is then cooled from 150°C to 70°C at constant pressure.
- (c) Finally, it is expanded isothermally to its original state.

Calculate W , Q , ΔU , and ΔH for each of the three processes and for the entire cycle. Take $C_v = (3/2)R$ and $C_p = (5/2)R$. ($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$) (16%)

4. Substance A reacts according to second order kinetics and conversion is 95% from a single flow reactor. We buy a second unit identical to the first. For the same conversion, by how much is the capacity increased if we operate these two units in parallel or in series?

- (a) The reactors are both plug flow. (12%)
- (b) The reactors are both CSTR. (12%)

5. The isomerization of butane



was carried out adiabatically in the liquid phase and the data in the table were obtained.

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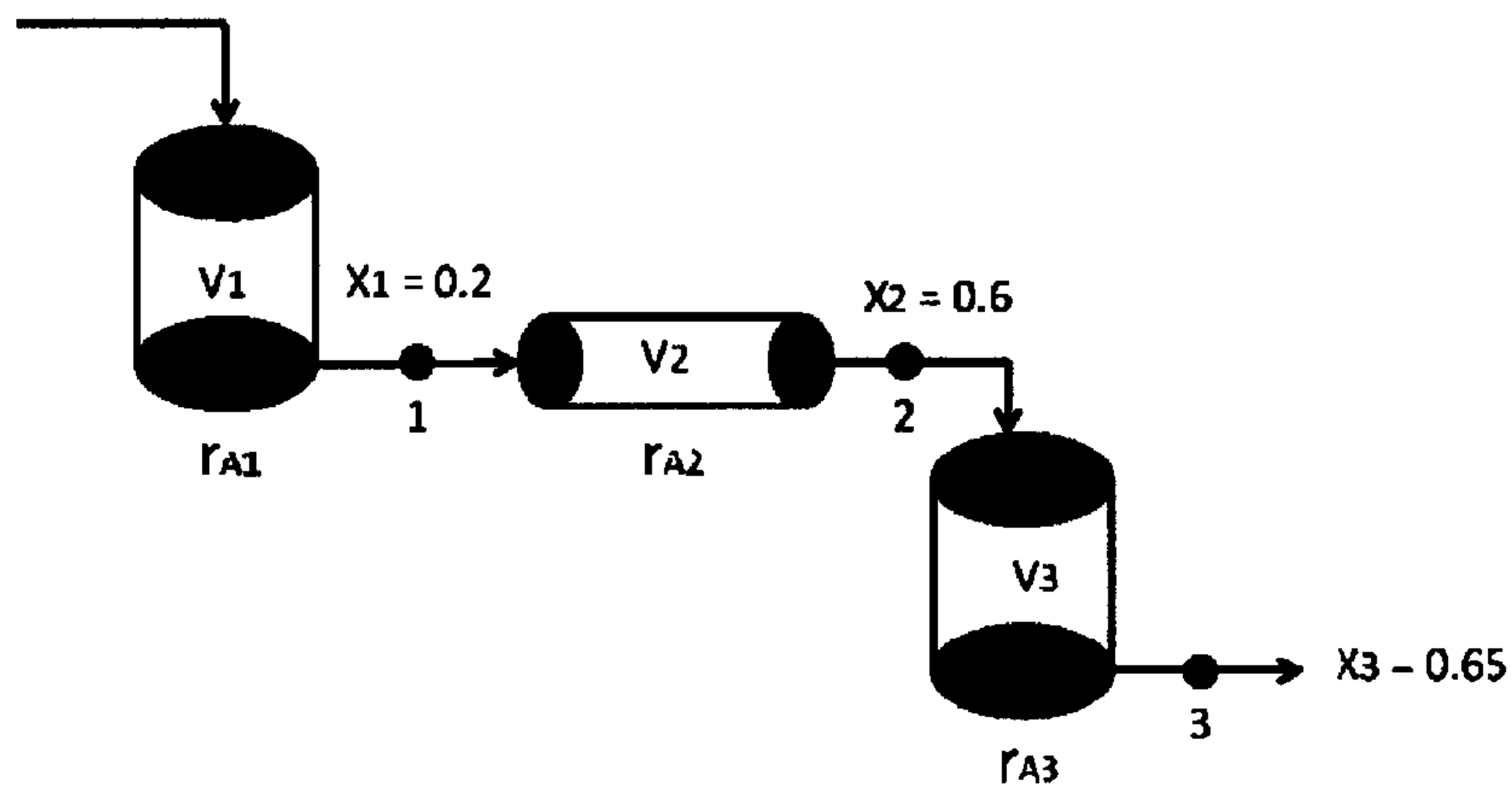
是否使用計算機：是

本科原始成績：100 分

Raw data

X	0.0	0.2	0.4	0.6	0.65
-r _A (kmol/m ³ .h)	39	53	59	38	25

Furthermore, the reactor scheme shown in the figure is used.



Calculate the volume of each of the reactors for an entering molar flow rate of n-butane of 50 kmol/hr. (24%)