第一部分選擇題(1~6)，請務必使用試卷第一頁[選擇題作答區]作答。(佔 30%)

(5%) 1. Suppose that 10.0 mol $C_2H_6(g)$ is confined to $4.86L$ at 27°C. Predict the compression factor, Z, of the ethane assuming that it is a van der Waals gas. The van der Waals constants for ethane are $a = 5.507 L^2\ atm\ mol^{-2}$ and $b = 0.0651 L\ mol^{-1}$ and the gas constant, R, is $0.082\ L\ atm\ K^{-1}\ mol^{-1}$.
(a) 0.92, (b) 0.84, (c) 0.70, (d) 0.61, (e) 0.55.

(5%) 2. Calculate the final temperature of a sample of argon of mass $12\,g$ that is expanded reversibly and adiabatically from $1.0L$ at $273.15K$ to $3.0L$.
(a) $131.0K$, (b) $163.0K$, (c) $208.0K$, (d) $236.0K$, (e) $315.2K$

(5%) 3. Calculate the standard enthalpy of formation of butane $\Delta_f H^\circ(butane, g)$ at 25°C from its standard enthalpy of combustion, $\Delta_{comb} H^\circ(butane, g) = -2878\,kJ\,mol^{-1}$, $\Delta_f H^\circ(CO_2, g) = -393.51\ kJ\,mol^{-1}$, and $\Delta_f H^\circ(H_2O, l) = -285.83\ kJ\,mol^{-1}$.
(a) $-95\ kJ\,mol^{-1}$, (b) $-125\ kJ\,mol^{-1}$, (c) $-152\ kJ\,mol^{-1}$, (d) $-220\ kJ\,mol^{-1}$, (e) $-305\ kJ\,mol^{-1}$

(5%) 4. When a certain fluid used in refrigeration was expanded adiabatically from an initial pressure of $32\,atm$ and 0°C to a final pressure of $1\,atm$, the temperature fell by $22\,K$. Calculate the Joule-Thomson coefficient, μ, at 0°C. Assuming it remains constant over this temperature range.
(a) $-2.2\,K\ atm^{-1}$, (b) $-1.5\,K\ atm^{-1}$, (c) $0.1\,K\ atm^{-1}$, (d) $0.7\,K\ atm^{-1}$, (e) $1.8\,K\ atm^{-1}$

(5%) 5. Calculate the increase in entropy when $1\,mol$ of a monatomic perfect gas with the molar heat capacity at constant pressure, $C_{p,m} = 5R/2$, where R is the gas constant, is heated from $300\,K$ to $600\,K$ and simultaneously expanded from $30\,L$ to $50\,L$.
(a) $-16\,J\,K^{-1}$, (b) $3\,J\,K^{-1}$, (c) $7\,J\,K^{-1}$, (d) $13\,J\,K^{-1}$, (e) $16\,J\,K^{-1}$

(5%) 6. When $2\,mol$ of a gas at $330\,K$ and $3.5\,atm$ is subjected to isothermal compression, its entropy decreases by $25\,J\,K^{-1}$. Calculate the final pressure of the gas.
(a) $60.8\,atm$, (b) $51.5\,atm$, (c) $43.3\,atm$, (d) $25.2\,atm$, (e) $15.7\,atm$

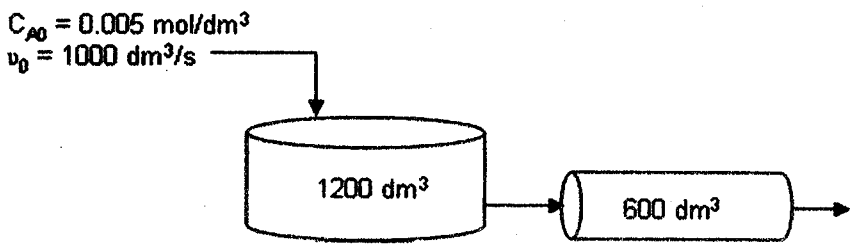
第二部分計算題(7-11)。(佔 70%)　※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

(10%) 7. By measuring the equilibrium between liquid and vapor phases of an acetone(A)/ethanol(E) solution at 57.2°C at $1\,atm$, it was found that $x_A = 0.4$ when $y_A = 0.516$. Calculate the activity coefficients of A and E in this solution on the Raoult's law basis. The vapor pressures of the pure components at this temperature are: $P_A^* = 786\,torr$ and $P_B^* = 551\,torr$. (x_A is the mole fraction in the liquid and y_A the mole fraction in the vapor.)

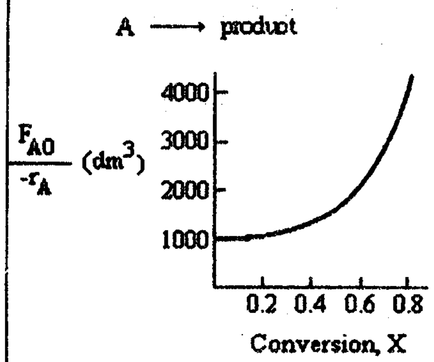
(10%) 8. The emf of the cell $Ag|AgI(s)|AgI(aq)|Ag$ is $0.95\,V$ at 25 °C. Calculate the solubility of AgI in the unit of $mol\,kg^{-1}$.

(15 %) 9. Use Levenspiel plots to calculate conversion from known reactor volumes

Pure A is fed at a volumetric flow rate of 1000 dm^3/h and at a concentration of 0.005 mol/dm^3 to an existing CSTR, which is connected in series to an existing tubular reactor.



If the volume of the CSTR is 1200 dm^3 and the tubular reactor volume is 600 dm^3, what are the intermediate and final conversions that can be achieved with the existing system? The reciprocal rate is plotted in the figure below as a function of conversion for the conditions at which the reaction is to be carried out.



(15%) 10. A first order reaction A(l) → B(l) is to be carried out adiabatically in a CSTR. Given A, E, T_0, υ_0, C_{A0}, and F_{A0}, find the reactor volume that produces a conversion X_A. The heat capacities of A & B are approximately equal, & $\dot{W}_S$=0.

a) Solve TEB (Total Energy Balance) for T:

b) Plug the k calculated for the reaction's temperature when the specified X_A is reached into the design equation to calculate V_{CSTR}

(20%) 11. The irreversible, elementary liquid-phase reaction 2A → B is carried out adiabatically in a flow reactor with $\dot{W}_S$=0 and without a pressure drop. The feed contains equal molar amounts of A and an inert liquid (I). The feed enters the reactor at 294 K with υ_0 = 5 dm^3/s and C_{A0}= 1 mol/dm^3. What would be the temperature inside of a steady-state CSTR that achieved X_A= 0.8? Extra info:

E = 10,000 cal/mol　C_{pA}= 15 cal/mol•K　C_{pB}= 30 cal/mol•K　C_{pI} = 15 cal/mol•K $\Delta H_A°(T_R)$ = -20 kcal/mol　$\Delta H_B°(T_R)$ = -50 kcal/mol　$\Delta H_I°(T_R)$ = -15 kcal/mol

k = 0.02 dm^3/mol•s at 350 K

試題隨卷繳回