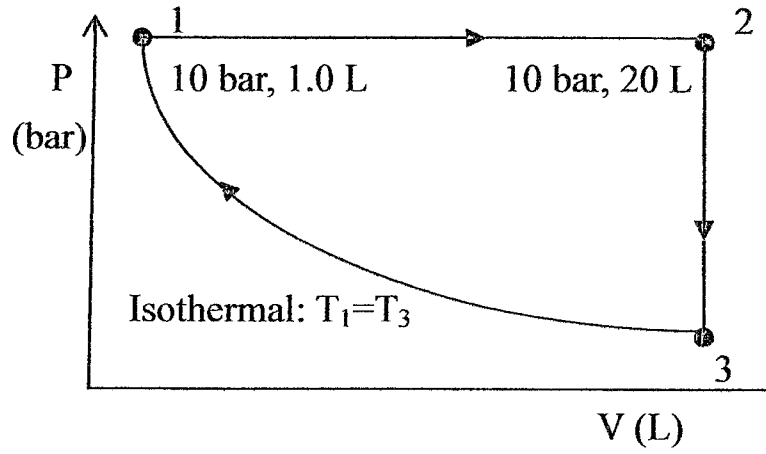
淡江大學 101 學年度轉學生招生考試試題

系別：化學工程與材料工程學系三年級　科目：物 理 化 學

考試日期：7 月 17 日(星期二) 第 3 節　　本試題共　五　大題，第一頁

1. Calculate the pressure P in Pa and compression factor Z of 2.0 mol $Ar_{(g)}$ confined at 300.0 K in 20.0 L, as it behaves as (a) a perfect gas, (b) a real gas obeying the virial equation: $PV_m=RT(1+BP)$ with the second virial coefficient = –20.0 (cm^3 mol^{-1}). (c) Comment on the Z value obtained as a real gas. Is the attractive or repulsive interaction greater for $Ar_{(g)}$? (gas constant R = 8.314 J mol^{-1} K^{-1}) (20 points)

2. A system containing 2.0 mol of a perfect gas for which molar heat capacity $C_{v,m}$ = 20 J mol^{-1} K^{-1} is taken through the cycle in the following diagram in the direction indicated by the arrows. Calculate *Q, W, ΔU and ΔH* in kJ for each segment (1→2; 2→3; 3→1) and for the cycle. Display your final answers in a Table like one below on your answer book. (30 points)



Path	*Q,*	*W,*	*ΔU*	*ΔH*
1→2				
2→3				
3→1				
cycle				

3. The vapor pressure of a liquid between 15°C and 35°C fits the expression: $ln(P) = 20.0 - 4000/T$ where P is pressure in Torr and T is temperature in K. Calculate (a) the enthalpy of vaporization in kJ mol^{-1}, (b) the normal boiling point in K, and (c) the entropy of vaporization at the normal boiling point in J mol^{-1} K^{-1}. (15 points)

4. The equilibrium constants of the reaction: $A_{(g)} \leftrightarrow B_{(g)} + C_{(g)}$ is found to fit the expression $ln\ (K_{eq}) = -1.00 - 1100/T + 1.50\times10^5/T^2$ between 300 K and 600 K. Calculate (a) equilibrium constant K_{eq} at 500 K; (b) standard reaction enthalpy in kJ mol^{-1} at 500 K; (c) standard reaction Gibbs energy in kJ mol^{-1} at 500 K, (d) and standard reaction entropy in J mol^{-1} K^{-1} at 500 K. (20 points)

5. The rate constants for a second-order reaction: $2A_{(g)} \rightarrow B_{(g)}$ are 1.60×10^{-2} L mol^{-1} s^{-1} at 300 K and 2.00×10^{-2} L mol^{-1} s^{-1} at 310 K. If the initial concentration of A is 0.1 mol L^{-1}, calculate (a) the half-life time ($t_{1/2}$) of the reactant *A* at 300 K. (b) the concentration of the product *B* after 30 min of reaction at 300 K? (c) the activation energy E_a (kJ/mol) for the reaction? (15 points)