注意事項：

1. 本試題共 4 題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

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1. The C_p of monoatomic gas A is 90 J/K·mol. Molecular weight of monoatomic gas A is 18.

   (a) Calculate entropy change of species A at 120°C and 10°C. Assume there is 2 kg of monoatomic gas with temperature of 120°C mixing with 1 kg of monoatomic gas A with temperature of 10°C. (10%)

   (b) Calculate the entropy change of the total process. (10%)

   (c) Calculate the heat at constant volume and at constant pressure for 20 moles of monoatomic gas A from 10°C to 120°C. Assume A is ideal gas. (10%)

2. For a chemical reaction: $2A \rightarrow B$, the rate increases by two folds when concentration of A increasing by two folds. The chemical reaction occurred at fixed pressure and temperature. The volume of mixture contains 60% of A, and reduced by 10% in 10 min. The reactor is batch reactor with variable volume. Calculate conversion of A and rate constant. (20%)

3. Derive the equation of initial rate as a function of the total pressure. The mechanism of a heterogeneous reaction with an inert gas presented is shown as follows.

   Adsorption: $P_{(g)} + S \leftrightarrow P \cdot S$

   Surface reaction: $P \cdot S + R_{(g)} \leftrightarrow Q \cdot S$

   Desorption: $Q \cdot S \leftrightarrow Q_{(g)} + S$

   Inert: $I + S \leftrightarrow I \cdot S$

   (a) Assume adsorption step of A is the limiting step. (15%)

   (b) Assume surface reaction step is the limiting step. (15%)

4. Liquid A and gas B consist a binary system at vapor-liquid equilibrium (VLE) at 25°C and 1 bar. It is assumed the ideal gas mixture in the vapor phase and the solubility of gas B in the liquid phase is quite low. The vapor pressure of liquid A is 0.032 bar at 25°C. The Henry's constant of gas B dissolved in liquid A is 40,000 bar at 25°C and 1 bar. Calculate the mole fraction of liquid A in the vapor phase and the solubility of gas B in the liquid phase. (20%)