國立成功大學

114學年度碩士班招生考試試題

編　號：66

系　所：資源工程學系

科　目：熱力學

日　期：0211

節　次：第 2 節

注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1 (a) Please derive and explain the meaning of the combined statement of the first and second laws, $dU = TdS - PdV$.
(b) Is the above statement valid for reversible or irreversible process?

2 An isolated system can be divided into two subsystem A and B. The two subsystem are allowed to exchange heat internally. Use the increase-in -entropy principle to prove that the direction of heat transfer is always from the hot subsystem to cold subsystem.

3 List the following reactions in the order of increasing reaction entropy. Explain your results.
(a) $C_{(s)} + MgO_{(s)} = Mg_{(s)} + CO_{(g)}$
(b) $C_{(s)} + O_{2(g)} = CO_{2(g)}$
(c) $C_{(s)} + SiO_{2(s)} = SiO_{(g)} + CO_{(g)}$
(d) $Zr_{(s)} + O_{2(g)} = ZrO_{2(s)}$
(e) $C_{(s)} + CO_{2(g)} = 2CO_{(g)}$

4 When pressure is increased, what will happen to the melting point of ice? what will happen to the boiling point of water? Explain your results.

5 In a binary A-B solution, the activity coefficient of A at temperature T is $\ln \gamma_A = \alpha X_B^2$, in which α is independent of composition. Please prove that the activity coefficient of B must be $\ln \gamma_B = \alpha X_A^2$. (hint: using Gibbs-Duhem eq.)

(20 points for each)