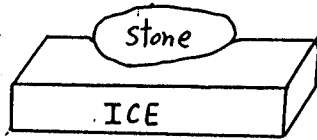


下列題目中, 1~6 題是必選題, 並請從 7, 8 兩題中,
任選一題作答。

1. Five liters of a monatomic gas (ideal) at 30°C and 10 atm pressure are expanded through an adiabatic ~~and~~ reversible process to a final pressure of 1 atm. Please calculate the change in entropy, work and internal energy for the gas. 10%
2. please discuss the minimum and maximum possible irreversible entropy change, ΔS_{irr} , of 1 mole of an ideal gas undergoing isothermal expansion from state A to state B. 10%
3. It is known that water and cyclohexane are immiscible with each other. Assume that the solubility of a material X in water is greater than that in cyclohexane. One dissolves certain amounts of X in both water and cyclohexane and mixed the two liquids for quite a long while. Will the activity of X, after the mixing process, in water be greater than, equal to, or less than that in cyclohexane? Explain. 10%
4. Assuming that C_p is constant and defining,
$$\alpha = \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_P$$
 15% please derive the expression for ΔH for a closed system under both temperature and pressure variation.
5. (a) please describe the Third Law of Thermodynamics.
(b) please define a "phase".
(c) please describe the "Partial Molar Quantity".
25% (d) The contact of two bricks at different temperature will give rise to an equilibrium temperature. Then, is "temperature" an intensive or extensive property?
(e) please define "state function" and give two examples of state function.

6. You might be familiar with the phenomenon that the ice will melt under a continuous steady pressing, e.g., by sitting a big piece of stone on a block of ice. Could you explain this phenomenon from the thermodynamic point of view?



7. The ideal gas law describes, for 1 mole of gas

$$PV = RT$$

while the van der waals gas equation is

$$15\% \quad \left(P + \frac{a}{V^2}\right)(V - b) = RT$$

The latter equation takes the finite volume of particles and the interactions among the particles of real gas into consideration. please rationalize the correction terms " $\frac{a}{V^2}$ " and " $-b$ ".

8. please make a corresponding sketch of the Gibbs free energy of mixing of components A and B at temperature T_1 of the following phase diagram.

15%

