

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please explain the following terminology: (1) Dalton's Law; (2) Isolated System; (3) Second law of Thermodynamics; (4) Phase Rule; (5) Nernst Equation; (20%)
2. What effects do van der Waals equation for real gas describe? Please choose correct one. (10%)
 - (1) Kinds of gases and temperature
 - (2) Temperature and pressure of the gas
 - (3) Sizes of gas molecules and force between gas molecules
 - (4) Sizes of the gas molecules and pressure of the gas
3. For the following processes, state whether each for the thermodynamic quantities q (heat), W (work), ΔU (internal energy), and ΔH (enthalpy) is greater than, equal to, or less than zero for the system described. Please explain your answers. (20%)
 - (1) An idea gas expands adiabatically against external pressure of 1 atm.
 - (2) An idea gas expands isothermally against external pressure of 1 atm.
 - (3) An idea gas expands adiabatically into a vacuum.
 - (4) A liquid at its boiling point is converted reversibly into its vapor, at constant temperature and 1 atm pressure.
 - (5) H_2 gas and O_2 gas are caused to react in a closed bomb at $25^\circ C$ and the product water is brought back to $25^\circ C$.
4. The freezing of a mole of supercooled water at $-10^\circ C$ is an irreversible process, what is the proper reason? (10%)
5. Which of the following statement is truth: (10%)
 - (1) The conductivity of a NaCl aqueous solution can be measured by using a DC current with Pt electrodes.
 - (2) A portable cell is a reversible cell.
 - (3) The emf E of a reversible cell can be determined by the Nernst equation.
 - (4) The equilibrium constant, K , of a cell reaction can be determined by the ΔH at constant T and P .
6. The ionic strength of a solution contains 0.1mol/kg NaCl and 0.05 mol/kg Na_2SO_4 ? (10%)
7. Consider the cell of $Pb|PbSO_4(s)|HSO_4^-(aq)$, please derive half reaction of lead reduction? (10%)
8. The mechanism of a reaction are as follows:
 - (1) $A_2 \rightarrow 2A$ (fast)
 - (2) $A+B \rightarrow P$ (slow)Please derive the rate equation of production of P ? (10%)