

※ 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) Derive an expression for the compression factor of a gas that obeys the equation of state $P(V-nb) = nRT$, where b and R are constants. If the pressure and temperature are such that $V_m = 10b$, what is the numerical value of the compression factor? (10%)
- (2) By direct differentiation of $H = U + PV$, obtain a relation between $(\frac{\partial H}{\partial U})_p$ and $(\frac{\partial U}{\partial V})_p$ (10%)
- (3) Derive the Maxwell relations: $(\frac{\partial P}{\partial T})_V = (\frac{\partial S}{\partial V})_T$ from A (Helmholtz energy) (10%)
- (4) Describing the definitions and basis of standard states for pure solid, solvent and solute. (10%)
- (5) Define the following terms: phase, component, and degree of freedom (10%)
- (6) What is Gibbs-Helmholtz equation? Please describe its usefulness (10%)
- (7) What is Clausius-Clapeyron equation? Please derive it (10%)
- (8) What is contact angle? Please describe its usefulness (10%)
- (9) Giving an account of the effect of pressure on (a) the position of equilibrium and (b) the equilibrium constant. (10%)
- (10) Suppose the gas-phase reaction $A = B$, $A = C$ and $B = C$ reach equilibrium at a fixed T . Express the equilibrium mole fraction of B in terms of equilibrium constants. (10%)