

國立成功大學

112學年度碩士班招生考試試題

編 號：85

系 所：資源工程學系

科 目：物理化學

日 期：0206

節 次：第 3 節

備 註：可使用計算機

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

1. Calculate the mass of water vapor present in a room of volume  $200 \text{ m}^3$  that contains air at  $27^\circ\text{C}$  on a day when the relative humidity is 50%. (10%)
2. A gas at  $350 \text{ K}$  and  $12 \text{ atm}$  has a molar volume 15% larger than that calculated from the perfect gas law. Calculate (a) the compression factor under these conditions and (b) the molar volume of the gas. Which are dominating in the sample, the attractive or the repulsive forces? (10%)
3. A sample of  $3.00 \text{ mol CH}_3\text{OH}_{(g)}$  is condensed isothermally and reversibly to liquid at  $64^\circ\text{C}$ . The standard enthalpy of vaporization of methanol at  $64^\circ\text{C}$  is  $35.3 \text{ kJ mol}^{-1}$ . Find  $w$ ,  $q$ ,  $\Delta U$ , and  $\Delta H$  for this process. (15%)
4. Calculate the final temperature of a sample of  $\text{CO}_2$  of mass  $8.8 \text{ g}$  that is expanded reversibly and adiabatically from  $300 \text{ cm}^3$  at  $298.15 \text{ K}$  to  $2.00 \text{ dm}^3$ . ( $C_{p,m}=37.11 \text{ J K}^{-1} \text{ mol}^{-1}$ ) (10%)
5. The enthalpy of vaporization of methanol is  $35.27 \text{ kJ mol}^{-1}$  at its normal boiling point of  $64.1^\circ\text{C}$ . Calculate (a) the entropy of vaporization of methanol at this temperature and (b) the entropy change of the surroundings. (15%)
6. Suppose that  $2.5 \text{ mmol Ar}_{(g)}$  occupies  $72 \text{ dm}^3$  at  $25^\circ\text{C}$  and expands to  $150 \text{ dm}^3$ . Calculate  $\Delta G$  for the process. (10%)
7. The vapor pressure of a substance at  $25^\circ\text{C}$  is  $60.1 \text{ kPa}$  and its enthalpy of vaporization is  $33.0 \text{ kJ mol}^{-1}$ . Estimate the temperature at which its vapor pressure is  $80.7 \text{ kPa}$ . (15%)
8. The standard enthalpy of a certain reaction is approximately constant at  $+125 \text{ kJ mol}^{-1}$  from  $800 \text{ K}$  up to  $1500 \text{ K}$ . The standard reaction Gibbs energy is  $+22 \text{ kJ mol}^{-1}$  at  $1120 \text{ K}$ . Estimate the temperature at which the equilibrium constant becomes greater than 1. (15%)