

國立成功大學  
110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： 0202

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. Five moles of gas at 1 bar and 27 °C are compressed at constant temperature by use of a constant pressure of 11 bar. How much work is done on the gas? If the compression is driven by a 200-kg mass, how far will the mass fall in the earth's gravitational field? (20%)
2. One mole of an ideal gas expands isothermally and at 25 °C from a volume of 5 L to a volume of 15 L. (20%)
  - (1) What is the change in the entropy of the gas?
  - (2) How much work is done on the gas?
  - (3) What is the change in the entropy of the surroundings?
  - (4) What is the change in the entropy of the system plus the surroundings?
3. What is the entropy of mixing of 1 mol of argon with 1 mol of oxygen at 298 K? (assuming that they are ideal gases) (10%)
4. An ideal gas at 300 K expands isothermally and reversibly from 20 to 2 bar against a pressure that is gradually reduced. Calculate  $q$  per mole and  $w$  per mole and each of the thermodynamic quantities  $\Delta\bar{U}$ ,  $\Delta\bar{G}$ ,  $\Delta\bar{H}$ , and  $\Delta\bar{S}$ . (20%)
5. What is the value of the equilibrium constant  $K_c$  for the dissociation of ethane into methyl radicals at 727 °C?  $\Delta_f G^\circ(C_2H_6) = 109.55 \text{ kJ mol}^{-1}$ ,  $\Delta_f G^\circ(CH_3) = 159.82 \text{ kJ mol}^{-1}$ . (15%)
$$C_2H_6(g) = 2CH_3(g)$$
6. Calculate the equilibrium pressure for the conversion of graphite to diamond at 298K. The densities of graphite and diamond may be taken to be 2.25 g/cm<sup>3</sup> and 3.51 g/cm<sup>3</sup>, respectively.  $\Delta_f G^\circ(\text{graphite}) = 0 \text{ kJ mol}^{-1}$ ,  $\Delta_f G^\circ(\text{diamond}) = 2.900 \text{ kJ mol}^{-1}$ . (15%)