國立成功大學

113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：0201

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. 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%)

2. 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^3 and 3.51 g/cm^3, respectively. $\Delta_f G°$(graphite) = 0 $kJ\ mol^{-1}$, $\Delta_f G°$(diamond) = 2.900 $kJ\ mol^{-1}$. (15%)

3. What pressure of nitrogen gas is required to produce a collision rate of 5.00×10^{19} s^{-1} at 252 °C on a circular surface of diameter 2.0 mm? (15%)

4. A certain solid sample adsorbs 0.63 mg of CO when the pressure of the gas is 36,000 Pa and the temperature is 27°C. The mass of gas adsorbed when the pressure is 4000 Pa and the temperature is 27°C is 0.21 mg. The Langmuir isotherm is known to describe the adsorption. Find the fractional coverage of the surface at the two pressures. (15%)

5. Calculate the frequency separation of the nuclear spin levels of a ^{14}N nucleus in a magnetic field of 15.4 T given that the magnetogyric ratio is 1.93×10^7 T^{-1} s^{-1}. (10%)

6. What is the standard enthalpy of a reaction for which the equilibrium constant is (a) doubled, (b) halved when the temperature is increased by 15°C at 37°C? (10%)

7. The equilibrium pressure of H$_2$ over solid uranium and uranium hydride, UH$_3$, at 227°C is 0.139 kPa. Calculate the standard Gibbs energy of formation of UH$_3$(s) at 227°C. (15%)