國立成功大學

115學年度碩士班招生考試試題

編　號：62

系　所：資源工程學系

科　目：物理化學

日　期：0204

節　次：第 3 節

注　意：1.可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. Calculate the work done when 50 g of iron reacts with hydrochloric acid in (a) a closed vessel of fixed volume, (b) an open beaker at 25°C. **(10%)**
2. Calculate the difference between the enthalpy change and the change in internal energy when the pressure is 1.0 bar given that the densities of the solids are 2.71 g cm^{-3} and 2.93 g cm^{-3}, respectively. (The internal energy change when 1.0 mol $CaCO_3$ in the form of calcite converts to aragonite is +0.21 kJ.) **(15%)**
3. Water is heated to boiling under a pressure of 1.0 atm. When an electric current of 0.5 A from a 12 V supply is passed for 300 s through a resistance in thermal contact with it, it is found that 0.798 g of water is vaporized. Calculate the molar internal energy and enthalpy changes at the boiling point (373.15 K). **(15%)**
4. Assume that the heat capacities are independent of temperature. The standard enthalpy of formation of gaseous H_2O at 298 K is −241.82 kJ mol^{-1}. Estimate its value at 100°C given the following values of the molar heat capacities at constant pressure: $H_2O(g)$: 33.58 J K^{-1} mol^{-1}; $H_2(g)$: 28.84 J K^{-1} mol^{-1}; $O_2(g)$: 29.37 J K^{-1} mol^{-1}. **(10%)**
5. Calculate the entropy change when argon at 25°C and 1.00 bar in a container of volume 0.500 dm^3 is allowed to expand to 1.000 dm^3 and is simultaneously heated to 100°C. **(15%)**
6. The molar constant-pressure heat capacity of a certain solid at 4.2 K is 0.43 J K^{-1} mol^{-1}. What is its molar entropy at that temperature? **(10%)**
7. Two moles of gas at 1 bar and 298 K are compressed at constant temperature by use of a constant pressure of 5 bar. How much work is done on the gas? If the compression is driven by a 100-kg mass, how far will the mass fall in the earth's gravitational field? **(15%)**
8. Given that the van der Waals constants of nitrogen are a = 1.408 L^2 bar mol^{-2} and b = 0 03913 L mol^{-1}. Estimate the fugacity of nitrogen gas at 50 bar and 298 K. **(10%)**