93學年度國立成功大學研究所招生考試　地球科學系　乙組　物理化學　試題　共 1 頁 第 1 頁

說明：1. 請依序作答並標明題號
2. 計算題必須寫出計算過程，只寫答案不給分
3. R=8.314 J mol^{-1} k^{-1}=1.987 cal mol^{-1} k^{-1}

1. The limiting molar conductivities of KCl, KNO_3, and $AgNO_3$ are 14.99 mSm^2mol^{-1}, 14.50 mSm^2mol^{-1}, and 13.34 mSm^2mol^{-1}, respectively (all at 25 ℃). What is the limiting molar conductivity of AgCl at its temperature ? (10%)

2. The enzyme-catalysed conversion of a substrate at 25 ℃ has a Michaelis constant of 0.035 $molL^{-1}$. The rate of the reaction is 1.15×10^{-3} mol $L^{-1}s^{-1}$ when the substrate concentration is 0.110 $molL^{-1}$. What is the maximum velocity of this enzymolysis?
(hint: $k = \frac{k_b[S]}{k_M + [S]}$ k_M: Michaelis constant, E: enzyme, S: substrate) (10%)

3. Derive the rate law for the decomposition of ozone in the reaction $2O_3(g) \rightarrow 3O_2(g)$ on the basis of the following proposed mechanism: (15%)
(1) $O_3 \rightleftharpoons O_3 + O$ (forward k_1, reverse k_1')
(2) $O + O_3 \rightarrow 2O_2$

4. Please answer the following questions:
(a) What physical meaning is the attributed to the square of the wave function,ψ^2 (5%)
(b) In the hydrogen atom what is the physical significance of the state for which $n=\infty$ and $E=0$ (5%)
(c) How many unpaired electrons are present in a Mn^{2+} ion ? (5%)

5. (a) One mole of an ideal gas expands reversibly from a volume of 2 to 20 liters at constant temperature. Calculate the entropy change of the system and of the surroundings. (b) The same isothermal expansion takes place irreversibly such that no work is done. Calculate the entropy change of the system and of its surroundings. (c) Using the answers you have accumulated, show numerically that the spontaneous contraction of an ideal gas in an isolated system would violate the second law of the thermodynamics. (30%)

6. The standard enthalpy of the reaction $N_2+3H_2 \rightarrow 2NH_3$ is -92.38 $KJmol^{-1}$ of ammonia and the standard Gibbs function is -33.26 KJ mol^{-1}, both at 289 K. Estimate the Gibbs function at (a) 500 K (8%) (b) 1000 K (8%) (c) Is the reaction spontaneous at 1000 K ? Why ? (4%)