

說明：請將題號及答案寫在答案紙上，不必抄題。  
計算題需寫出計算過程，否則不予計分。

- (1) What is the pH of 1.0 L of a solution of 100.0g of glutamic acid ( $C_5H_9NO_4$ , a diprotic acid;  $K_1 = 8.5 \times 10^{-5}$ ,  $K_2 = 3.39 \times 10^{-10}$ ) to which has been added 27.2 g of NaOH (M.W. = 40) during the preparation of monosodium glutamate? (10%)
- (2) Consider the following reaction at 500 K and 100 bar  
 $CO + 2 H_2 \rightleftharpoons CH_3OH$        $K_{eq} = 6.23 \times 10^{-3} \text{ bar}^{-2}$   
 (a) If the reactant gases contain a mole of nitrogen in addition to 1 mole of CO and 2 moles of hydrogen, what is the equilibrium extent of reaction?  
 (b) Would the equilibrium extent of reaction be larger or smaller if nitrogen is absent, but others remain the same as that in (a)? Why? (20%)
- (3) Consider the following the reaction at 25 °C and 1 atm  
 $CH_4(g) + 2 O_2(g) \rightleftharpoons CO_2(g) + 2 H_2O(l)$        $\Delta H_{298}^\circ = -890 \text{ KJ}$   
 Calculate the work done on the system and the change of internal energy. (13%)
- (4) Calculate the potential for the following cell at 25 °C  
 $Pt | H_2(g)(0.79 \text{ atm}) | H_3O^+(0.50 \text{ M}) || Cl^-(0.05 \text{ M}) | Cl_2(g)(0.10 \text{ atm}) | Pt$   
 given that  $E^\circ = 1.3595 \text{ V}$  for  $Cl_2 + 2 e^- \rightleftharpoons 2 Cl^-$  (12%)
- (5) The mass of the atom  $^{19}F$  is 18.99840 amu. The mass of neutron, proton, and electron is 1.0087, 1.0073 and 0.00055 amu, respectively. Calculate the binding energy per nucleon in an unit of Mev. (12%)
- (6) Write Lewis structures for all the isomers of the alkene  $C_4H_8$ . (9%)
- (7)(a) Why is it important to substitute other kinds of compounds for chlorofluorocarbons (CFC's) in air conditioning and other important practical applications?  
 (b) Why are hydrochlorofluorocarbons (HCFC's) thought to be better choices than CFC's? (12%)
- (8) Explain the greenhouse effect. What can be done about it? (12%)