系組：化學工程與材料工程學系二、紡織工程學系三年級　　日期節次：7月29日第4節

15:20-16:40

科目：普通化學　(154-172)

Problems : 70%

1. The rate equation for decomposition of N_2O_5 is Rate = $k[N_2O_5]$. The value of k is $6.7\times10^{-5}s^{-1}$. Calculate the half-life time of N_2O_5. 10%

2. The activation energy Ea for a reaction is 260 kJ/mol. At 800k, the rate constant $k = 0.0315\,s^{-1}$. Determine the value k at 850K. 10%

3. A reaction has rate equation, Rate = $k[A]^2$, How will the rate change if the concentration of A is doubled? If the concentration of A is halved? 10%

4. You dissolve 15.0g of sucrose, $C_{12}H_{22}O_{11}$, in a cup of 225g water. What is the freezing point of the solution? k_f of H_2O is -1.86. 10%

5. Calculate the osmotic pressure of a 0.0120M solution of NaCl in water at 0°C. Assume the van't Hoff i factor is 1.96 for this solution. 10%

6. You burn 0.1523g of an unknown compound $C_xH_yO_z$ and isolate 0.3718g of CO_2 and 0.1522g of H_2O. What's the empirical formula of the compound? If molecular weight is 72.1 g/mol, what's the molecular formula? C=12.0, O=16.0, H=1.0　10%

7. Data for reaction $CO_{(g)} + NO_{2(g)} \longrightarrow CO_{2(g)} + NO_{(g)}$ are given in the table below. 10%

Experiment	[CO] in M	[NO_2] in M	rate in M/h
1	5.0×10^{-4}	0.36×10^{-4}	3.4×10^{-8}
2	5.0×10^{-4}	0.18×10^{-4}	1.7×10^{-8}
3	1.0×10^{-3}	0.36×10^{-4}	6.8×10^{-8}

What is the rate constant for the reaction?

B. Questions : 30%

1. Complete the following equations. 5%

(1) $^{82}_{35}Br \rightarrow {}^{82}_{36}Kr + ?$

(2) $^{231}_{91}Pa \rightarrow {}^{227}_{89}Ac + ?$

(3) $^{9}_{4}Be + ? \rightarrow {}^{6}_{3}Li + {}^{4}_{2}He$

(4) $^{40}_{20}Ca + ? \rightarrow {}^{40}_{19}K + {}^{1}_{1}H$

(5) $^{26}_{13}Al \rightarrow {}^{25}_{12}Mg + ?$

2. Indicate two types of catalysis. 5%

3. Which is the stronger acid? 5%

(1) $ClCH_2COOH$, $pK_a = 2.87$, (2) CH_3COOH, $K_a = 1.8\times10^{-5}$

4. Consider the following molecules : 5%

(1) H_2O (2) NH_3 (3) O_2 (4) Cl_2 (5) CCl_4 (6) $BeCl_2$ (7) C_6H_6

Which compounds are not polar?

5. Which pairs of liquids will be miscible? 5%

(1) H_2O and $CH_3CH_2CH_2CH_3$ (2) C_6H_6 and CCl_4

(3) H_2O and CH_3COOH (4) CCl_4 and H_2O

6. Define acid and base according to Arrhenius and Brønsted–Lowry theory. 5%