中國文化大學 98 學年度轉學招生考試

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 vant Hoff i factor is 1.94 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 $CO_{(g)} + NO_{2(g)} \rightarrow CO_{2(g)} + NO_{(g)}$ are given in the table below. 10 %

| Experiment | [CO] in M | [$NO_2$] in M | rate in M/h |
|---|---|---|---|
| 1 | $5.0\times10^{-4}$ | $0.36\times10^{-4}$ | $3.4\times10^{-8}$ |
| 2 | $5.0\times10^{-4}$ | $0.18\times10^{-4}$ | $1.7\times10^{-8}$ |
| 3 | $1.0\times10^{-3}$ | $0.36\times10^{-4}$ | $6.8\times10^{-8}$ |

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) $CO_2$ (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%