臺灣綜合大學系統111學年度學士班轉學生聯合招生考試試題

科目名稱	普通化學A	類組代碼	共同考科
		科目碼	E0017

※本項考試依簡章規定所有考科均「不可」使用計算機。　　本科試題共計 3 頁

一、計算題與簡答題 共10題：請依序作答；計算題請詳列計算過程才予計分

1. (a) For the hypothetical reactions 1 and 2, $K_1 = 10^2$ and $K_2 = 10^{-4}$; Please calculate K3 value. (5%)

   1. $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ K_1
   2. $2A_2(g) + C_2(g) \rightleftharpoons 2A_2C(g)$ K_2
   3. $A_2C(g) + B_2(g) \rightleftharpoons 2AB(g) + (1/2)C_2(g)$ $K_3 = ?$

   (b) Calculate the ratio of the change in momentum per wall impact for Ar(g) to that for He(g) if the gases are at the same temperature and pressure. (He : 4.0 ; Ar : 40.0) (5%)

2. (a) A 0.10 M solution of the salt NaA has pH = 9.0. Calculate K_a for the acid HA. (5%)

   (b) Calculate the pH when 200.0 mL of a 1.00 M solution of H_2A ($K_{a1} = 1.0 \times 10^{-6}$, $K_{a2} = 1.0 \times 10^{-10}$) is titrated with the 100 mL of 1.00 M NaOH. (5%)

3. (a) What is Henry's law? Use this law to explain the fizzing when opening a can of soda. (4%)

   (b) Draw the phase diagram of CO_2 the T_3 (triple point: 5.1 atm, –56°C) and use this phase diagram to explain why only sublimation occurs at 1.0 atm. (6 %)

4. (a) Why is the vibration frequency of C–H bond at 2850–3300 cm^{-1} higher than that of C–O bond at 1080–1300 cm^{-1}? (4 %).

   (b) Draw and brief describe a ^{1}H-NMR spectrum of the CH_3CH_2–Br. (including the internal standard TMS, chemical shift and spin-spin coupling) (6 %)

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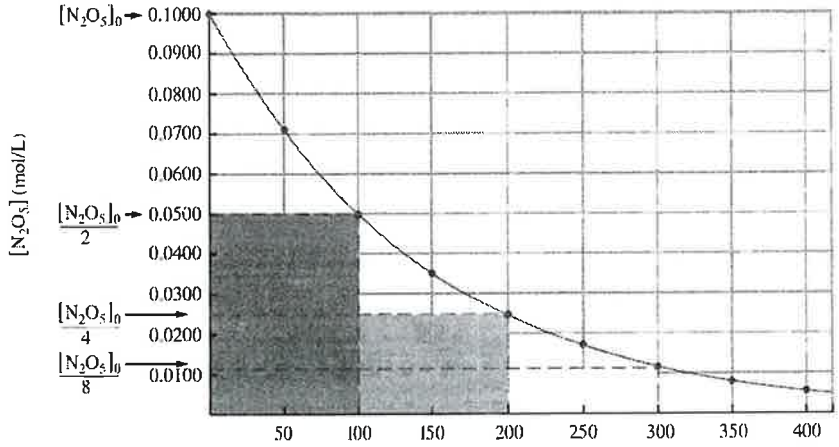
5. (a) Derive the integrated rate law of second-order reaction. (5 %)

(b) Why is the reaction in the following plot a first-order reaction? (3 %)

and also calculate the rate constant of this reaction. (2 %)



6. Calculate the following thermodynamic properties of 1 mole monatomic idea gas, (1). Internal energy at 27 °C, (2). C_p ; (3). $\triangle S$ = ? when the volume changes from V to 4V at T = 50°C. (4). What is the potential energy at 50°C? (gas constant = R; 10 %)

7. (a) Write the Schrödinger equation for the particle in a box. (3 %)

(b) What is the energy of an electron with the mass m_e confined in a box with a length of L at the lowest 4^{th} energy level. (3 %)

(c) As the length of the nanoparticles increases, how the energy gap ($\triangle E$) changes? (no change, increase or decrease?); why? (4 %)

8. Use the molecular orbital model and draw MO energy-level diagrams to predict the magnètism and bond order of NO molecule and NO^+ ion. (10 %)

背面有題，請繼續作答。

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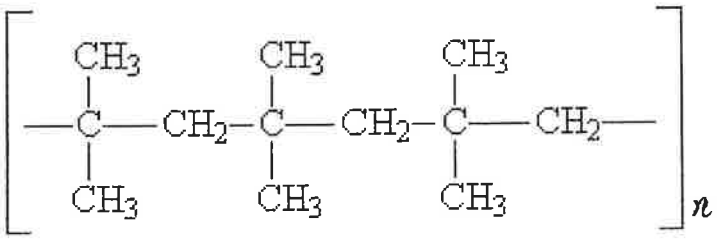
9. (a) Please draw all the structural and geometric isomers are there of chloropropene? (4%)

(b) What compound does the oxidation of secondary alcohols results in? (3%)

(c) What monomer(s) is (are) needed to produce the following polymer?(3%)



10. (a) Please use the crystal field model to predict how many unpaired electrons are there in a complex ion having a d^6 electron configuration and an octahedral geometry in the weak-field case? (4%)

(b). Please use the crystal field model to predict how many unpaired electrons are found in $Mn(NH_3)_4^{3+}$ (tetrahedral)? (Mn: $4s^2 3d^5$) (4%)

(c) Which transition metal is a component of vitamin B_{12}? (2%)