國立高雄師範大學 100 學年度碩士班招生考試試題

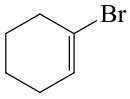
（請用藍、黑色筆作答，以其他顏色或鉛筆作答者不予計分）

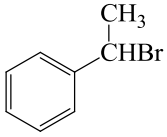
系所別：化學系

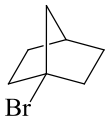
科　目：綜合化學二（含有機化學、物理化學）（第 **1** 頁，共 **3** 頁）

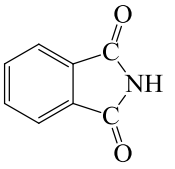
一、簡答題：（每題 6%，共計 36%）

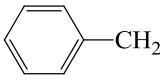
(1) 說明下列溴化物在 MeOH 液中進行 S_N1 反應時，其反應速率大小順序為何？簡述原因。

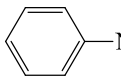
（a）$(CH_3CH_2)_2CHBr$ ；（b） 

；（c） 

與　（d） 

(2) 依 Gabriel synthesis 法利用 

合成 

，請寫出完整化學反應式，其中為何無法合成 

？

(3) 某有機化合物的質譜中呈現分子離子（M^+）在 m/e＝78，其吸收峰相對強度為 20.1，另外在 m/e＝79；m/e＝80 與 m/e＝81 者吸收峰之相對強度分別為 0.9；6.68 與 0.22，試預測此化合物之分子式，簡述理由。

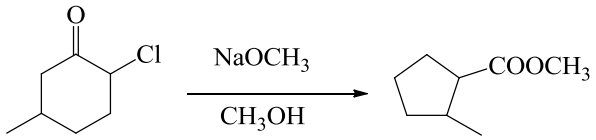
(4) 化合物 $C_{11}H_{14}O_2$ 的光譜資料如下：^{1}H NMR：δ1.0（t, 3H）；δ1.3（m, 2H）；δ3.5（t, 2H）；δ3.8（s, 2H）與 δ7.3（m, 5H），而 IR 光譜在 1735cm^{-1} 有強吸收，請推導其正確化學結構式。

(5) 為何 $(CH_3)_2CH\text{-}CH{=}CH_2$ 在 Br_2/CCl_4 中進行加成反應時，不易形成 $(CH_3)_2CBrCH_2CH_2Br$ 產物？但 $H_2NCH_2CHClCH_2CH_3$ 在 OH^- 液中為何可生成 $HOCH_2\underset{\displaystyle NH_2}{\underset{|}{C}}HCH_2CH_3$ ？

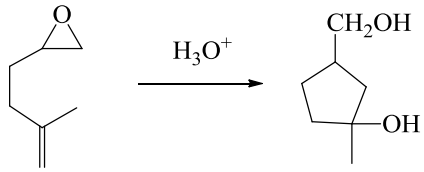
（背面有題）

(6) 完成下列反應機構

（a）

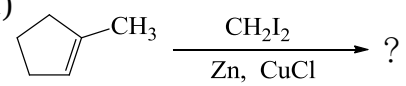


（b）

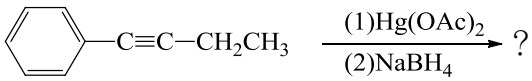


二、寫出下列反應主要產物之化學結構式（每題 2%，共計 14%）

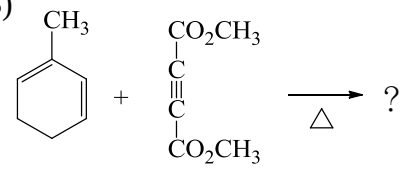
(1)



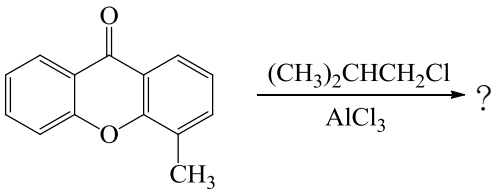
(2)



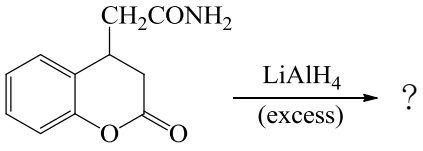
(3)



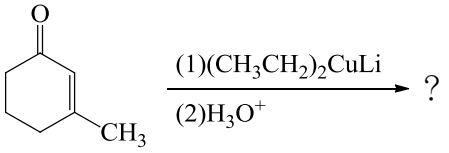
(4)



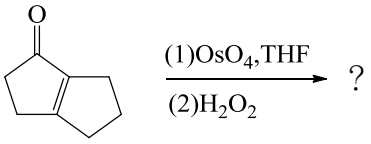
(5)



(6)



(7)



三、One mole of an ideal gas at 25 ^{o}C and 1 bar is expanded reversibly and isothermally to a pressure of 0.1 bar. What are the values of (1) q (joule) , (2) w (joule) , (3) ΔU (joule) , (4) ΔH (joule) , (5) ΔG (joule) , (6) ΔA (joule) and (7) ΔS (joule/K) ?（14%）

四、The standard electromtiove force of the cell　Pt | H_2(g) | HCl(ai) | AgCl(s) | Ag　has been determined from 0 to 90 ^oC　by R. G. Bates and V. E. Bower. Their data may be represented by　$E = 0.23659 - 4.8564 \times 10^{-4}\ t - 3.4205 \times 10^{-6}.\ t^2 + 5.869 \times 10^{-9}\ t^3$ (the unit of E is V, the unit of t is ^oC–). Please determine (1) ΔG^o (joule/mole) , (2) ΔS^o (joule/(k*mole)) , (3) ΔH^o (joule/mole) and (4) $\Delta C_p{}^o$ (joule/(K*mole)) at 25 ^oC for the reaction 1/2H_2 (g) + AgCl(s) = HCl(ai) + Ag(s)（8％）

五、The simplest problem to treat in quantum mechanics is that of a particle of mass *m* constrained to move in a one-dimensional box of length *a*. The potential energy *V(x)* is taken to be 0 for $0 < x < a$ and infinite outside this region. Please answer the following questions for this simplest problem: (1) What is the Hamiltonian operator? (2) What is the time-independent Schrodinger equation? (3) What is the total energy of ground state? (4) What is the zero-point energy? (5) What is the time-independent wave function of ground state? (6) What is the time-dependent Schrodinger equation? (7) What is the time-dependent wave function of ground state?（14％）

六、For O (g), the following terms may arise:　$^1S_0$　$^1D_2$　$^3P_0$　$^3P_1$　$^3P_2$　. Please answer the following questions: (1) Which term is ground state? (2) How many microstates in $^3P_2$? (3) How many microstates in all terms? (4) What is the electronic partition function *q* for O(g) at very high temperature? (5) What is the electronic partition function *q* for O(g) at 0K?（10％）

七、For $k = aT^m \exp[-b/(k_BT)]$, where *k* is rate constant, k_B is Boltzmann constant and T is absolute temperature, please derive the Arrhenius parameters, Ea and A.（4％）