系所(組)別：應用化學研究所碩士班 | 考試科目：有機化學與分析化學

分析化學 (50%)

I. 解釋名詞 (30%, 每小題 3%)

1. Brönsted-Lowry theory
2. Beers law
3. Debye-Hückel equation
4. EDTA
5. Le Châtelier principle
6. Nernst equation
7. Zwitterion
8. p-value
9. Van Deemter equation
10. Kjeldahl method

II. (10%) 計算 50.0mL H_3PO_4 與 50.0mL KH_2PO_4 混合溶液, 其 $[H_3O^+]$ 濃度為何?

(H_3PO_4 的 $K_1 = 7.11 \times 10^{-3}$, $K_2 = 6.32 \times 10^{-8}$, $K_3 = 4.5 \times 10^{-13}$)

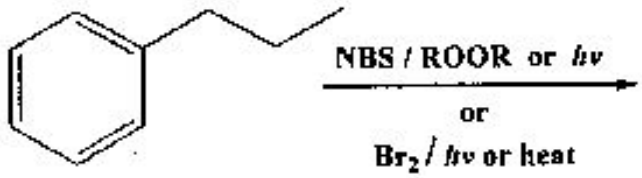
III. (10%) 由下列半反應電位, 計算 AgCl 的 K_{sp} 為何?

$$Ag^+ + e^- \rightleftharpoons Ag^\circ \quad E^\circ = 0.799\ V$$

$$AgCl + e^- \rightleftharpoons Ag + Cl^- \quad E^\circ = 0.222\ V$$

Ⅳ. Give the strustures of the major organic products of the following reactions : 2 points each

(1)



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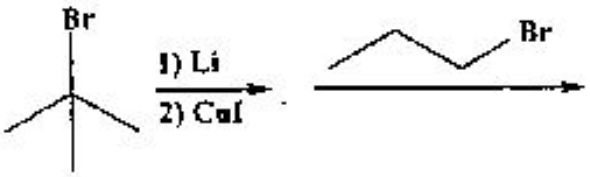

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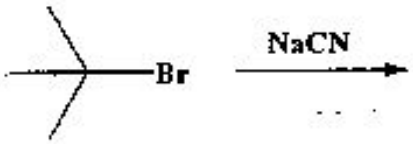

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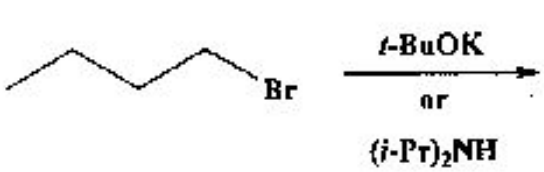

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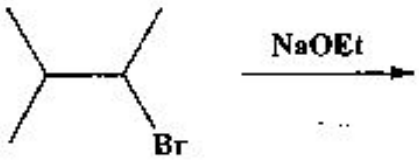

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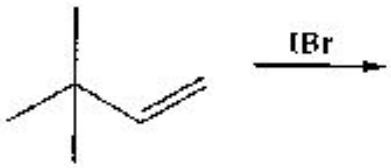

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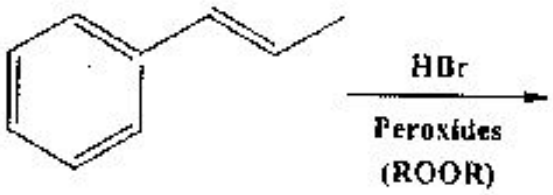

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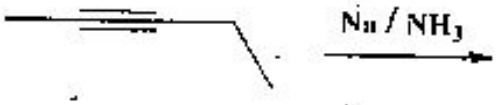

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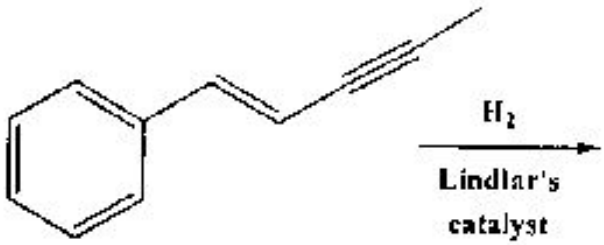

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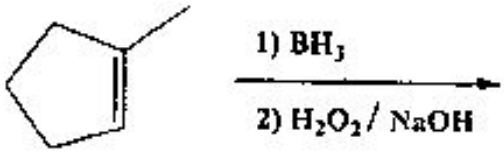

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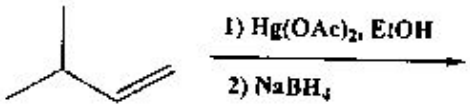

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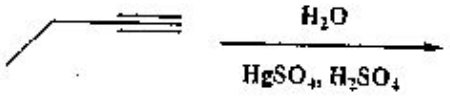

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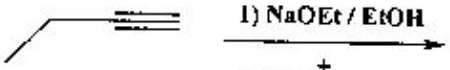

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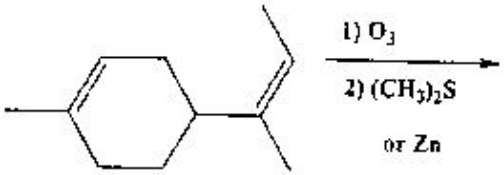

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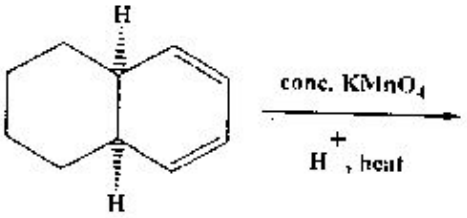

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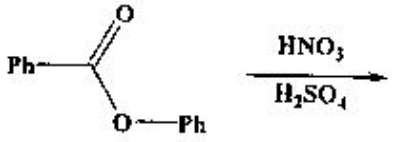

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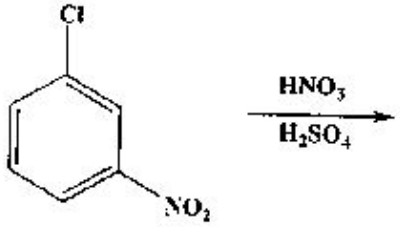

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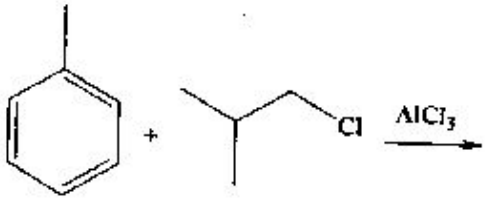

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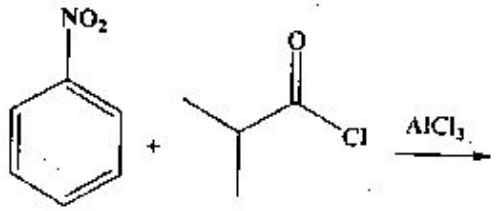

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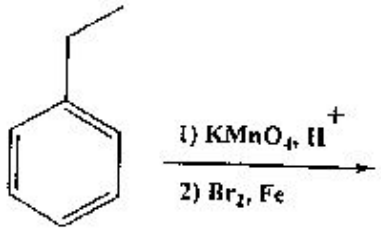

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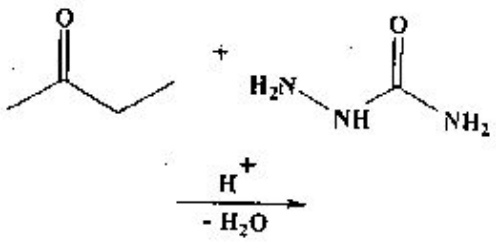

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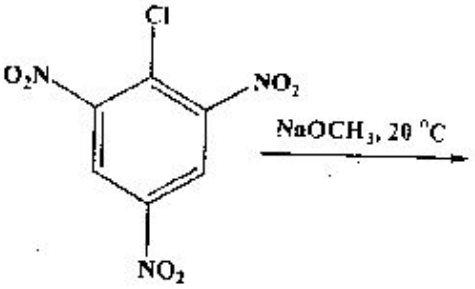

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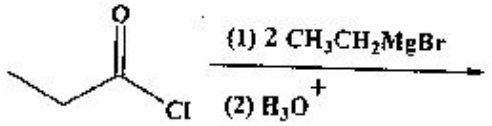

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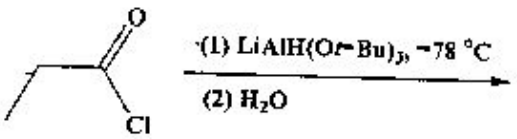

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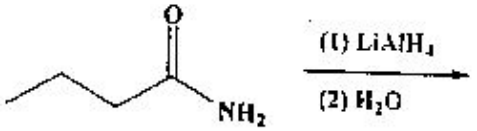

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1. Predict whether these complexes would be labile or inert and explain your choices.
   (a) $[Cr(CN)_6]^{4}$
   (b) $[Cr(H_2O)_6]^{2+}$　　(10 %，每小題五分)

2. For both $[CoF_6]^{3}$ (octahedral) and MnO_4^- (tetrahedral)：(50 %，每小題十分)
   (a)Predict the number of unpaired electrons.
   (b)Find the magnetic moment.
   (c)Calculate the ligand field stabilization energy.
   (d)Decide which is paramagnetic.
   (e)Find the ground state term symbol.

3. On the basis of VSEPR, predict the structures of　　(20 %，每小題五分)
   (a) XeO_2F_2
   (b) SOF_4
   (c) I_3^-
   (d) N_3

4. Determine the point groups for　　(20 %，每小題五分)
   (a) cyclohexane (chair form)
   (b) B_2H_6
   (c) $(C_5H_5)_2Fe$ (ferrocene)
   (d) $B_6H_6^{2-}$

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1.(10) State the barometric distribution law in terms of equation.

2.(10) State the First, Second and Third law of Thermodynamics in terms of equations.

3.(10) Prove $\left(\frac{\partial U}{\partial V}\right)_T = \frac{a}{V_m^2}$; U : internal energy, V : Volume, a : Van der Waals constant

What is the internal pressure ?

4.(10) There are large discrepancies between the observed preexponential factors and the collision frequency. Explain why the rate constant obtained from the Transition Theory instead of the Arrhenius Equation has less discrepancies between the observed preexponential factors and the collision frequency.

5.(10) A variety of experimental evidence has shown that the reaction occurs to a large extent by the mechanism as follows :

1. $CH_3CHO \xrightarrow{k_1} CH_3 + CHO$
2. $CH_3 + CH_3CHO \xrightarrow{k_2} CH_4 + CH_3CO$
3. $CH_3CO \xrightarrow{k_3} CH_3 + CO$
4. $CH_3 + CH_3 \xrightarrow{k_4} C_2H_6$

Derive the rate equation for the above mechanism.

Use equation and figure as much as possible.

6. Explain Schrodinger equation. (10)

7. Illustrate Frank-Condon principle. (10)

8. Describe principles, features and applications of laser.(30)

系所(組)別：應用化學研究所碩士班 | 考試科目：生物化學

一、選擇題（每小題5分，共30分）。

（1） 在glycolysis的過程中，從 fructose-1,6-biphosphate轉換成 glyceraldehyde-3-phosphate，所需之酵素爲何？（a）kinase （b）aldolase （c）isomerase

（2） 在 catabolic pathway 中，glucose 位置 2 的碳原子，在何時代謝分解爲二氧化碳？（a）在 pyruvate 轉換成 acetyl-CoA 的步驟中（b）在進入 citric acid cycle 中的第一次循環時 （c）在進入 citric acid cycle 中的第二次循環時 （d）在進入 citric acid cycle 中的第三次或更多次以後的循環時

（3） 下列哪一個反應包含 NADH 的生成？ （a）OAA + acetyl-CoA → citrate （b）α-ketoglutarate → succinyl-CoA （c）fumarate → L-malate

（4） 下列哪一個反應會消耗 ATP？ （a）succinate → fumarate （b）3-phosphoglycerate → 1,3-bisphosphoglycerate （c）glyceraldehyde-3-phosphate → 1,3-bisphosphoglycerate

（5） 下列何者不爲 carbohydrate metabolism 的 regulation site？ （a）isocitrate → α-ketoglutarate （b）OAA → PEP （c）glucose-6-phosphate → fructose-6-phosphate

（6） 下列何者不爲 pyruvate dehydrogenase complex 的 cofactor？ （a）TPP （b）Mg^{2+} （c）lipoate

二、請畫出下列分子的化學結構（每小題5分，共20分）

（1）threonine （2）arginine （3）adenosine （4）dCMP

三、請解釋何謂蛋白質之一級、二級、三級和四級結構？（10分）

四、在酵素催化反應中，如何區別受質（substrate）與抑制劑（inhibitor）間爲競爭型反應（competitive inhibition）或非競爭型反應（noncompetitive inhibition）？（15分）

五、請解釋 tRNA、mRNA、rRNA 的功能？（10分）

六、請描述脂肪酸在細胞內的合成方式。（15分）