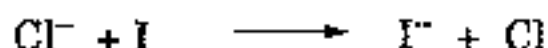


八十四學年度 化學研究所 化學組 應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 0702 共 8 頁第 1 頁 *請在試卷【答案卷】內作答

- (6%) 1. Which of the following gas-phase reactions can proceed spontaneously?



- (5%) 2. The conductivity of BrF_3 is enhanced by adding either AgF or SnF_4 . Explain this enhancement, using the appropriate chemical equations.

- (4%) 3. Determine the point groups for:
(a) IOF_3 (b) IO_2F_2^-

- (5%) 4. Is the reaction $[\text{Co}(\text{NH}_3)_6]^{3+} + [\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ likely to proceed by an inner-sphere or outer-sphere mechanism? Explain your answer.

- (5%) 5. $\text{cis-PtCl}_2(\text{PEt}_3)_2$ is stable in benzene solution. However, small amounts of free triethylphosphine catalyze establishment of an equilibrium with the trans isomer:



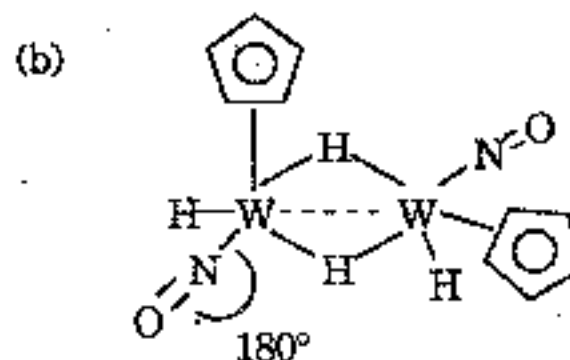
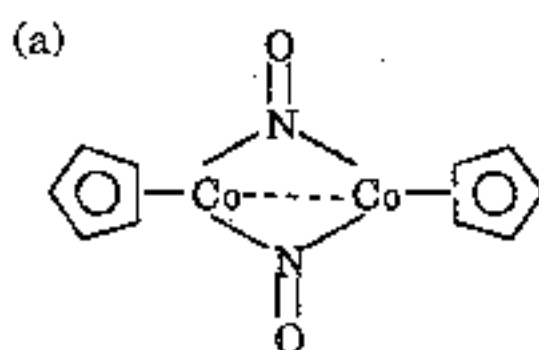
Why is free triethylphosphine necessary to catalyze the isomerization? Describe the role of triethylphosphine in this reaction.

八十四學年度 化學研究

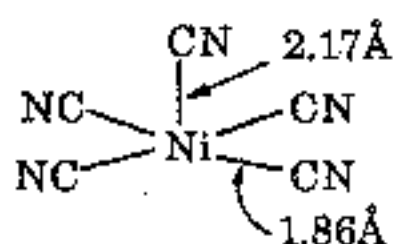
化學組 應用化學 組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 0702 共 8 頁第 2 頁 *請在試卷【答案卷】內作答

- ((5%)) 6. Calculate the bond order of metal-metal bond if the following complexes meet 18 electrons. You must show the calculation procedure for your answer.



- ((3%)) 7. The molecular structure of $\text{Ni}(\text{CN})_5^{2-}$ is given below.

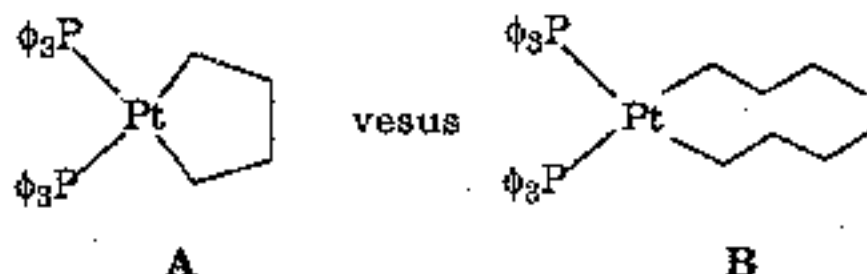


Why in this square pyramide structure, the Ni-CN (basal) distance (1.86 Å) is much shorter than that (2.17 Å) of Ni-CN (apical) distance.

八十四學年度 化學研究所 化學組 應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 共 8 頁第 3 頁 *請在試卷【答案卷】內作答

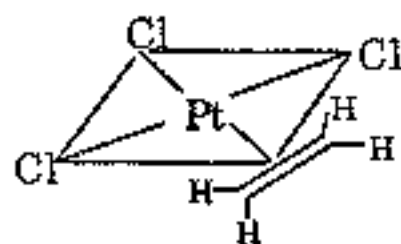
- (5%) 8. For the two compounds below A and B, which one is more stable at room temperature? Give the details of decomposition mechanism.



- (4%) 9. Write detail of the reaction products. If they do occur.

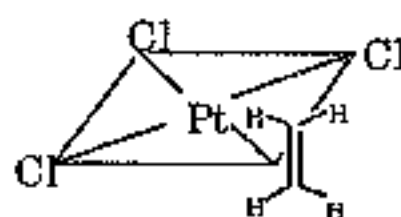


- (8%) 10. (a) Choose the correct structure of $\text{PtCl}_3(\text{CH}_2=\text{CH}_2)^-$ and $\text{Ni}(\text{PPh}_3)_2(\text{CH}_2=\text{CH}_2)$.



the C=C bond is on the PtCl_3 plane

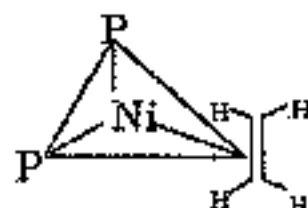
or



the C=C bond is perpendicular to the PtCl_3 plane

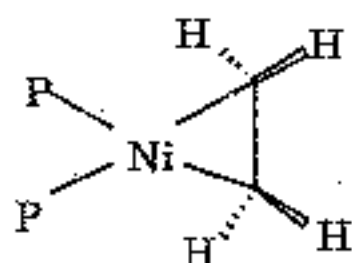
八十四學年度 化學研究所 化學組 應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 0702 共 8 頁第 4 頁 *請在試卷【答案卷】內作答



the C=C bond is
perpendicular
to the NiP_2 plane

or



the C=C bond is coplanar
with NiP_2 fragment

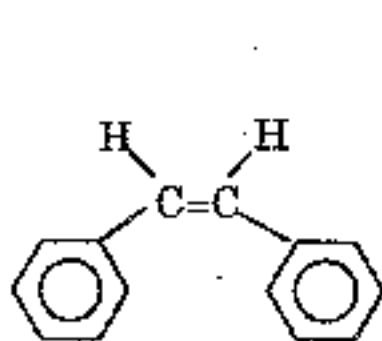
- (b) For $\text{PtCl}_3(\text{CH}_2=\text{CH}_2)^-$ and $\text{Ni}(\text{PPh}_3)_2(\text{CH}_2=\text{CH}_2)$, which one has a longer C=C bond distance in the ethylene group. Give your reason.

- (6%) 11. How could you use simple chemical test and IR spectroscopy to distinguish between the following isomers?
- (a) 1,3-hexadiene and 1-hexyne
 - (b) anisole and benzyl alcohol
 - (c) 2-hexanone and hexanal
- (4%) 12. Draw the structure of a compound with each of the following molecular formulas that will show only one peak in its proton NMR spectrum.
- (a) $\text{C}_{12}\text{H}_{18}$ (b) C_6H_{12} (c) C_5H_{12} (d) C_4H_6
- (4%) 13. Do you expect that the ^1H and ^{13}C NMR spectra of (*R*)-2-pentanol and (*S*)-2-pentanol to be different? Explain.

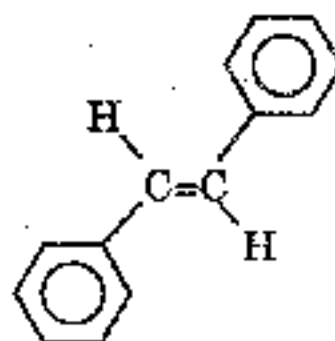
八十四學年度 化學研究所 化學組 應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 0702 共 8 頁第 5 頁 *請在試卷【答案卷】內作答

- (6%) 14. The $\lambda_{\max}$ for *cis*-stilbene is at shorter wavelength (280 nm) than for *trans*-stilbene (295 nm). Suggest an explanation.

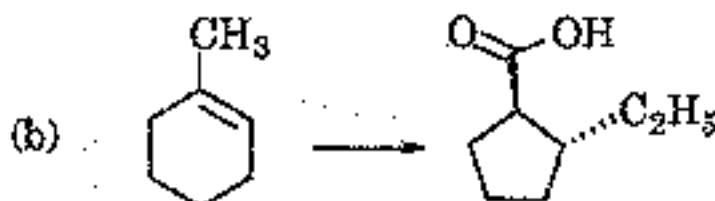
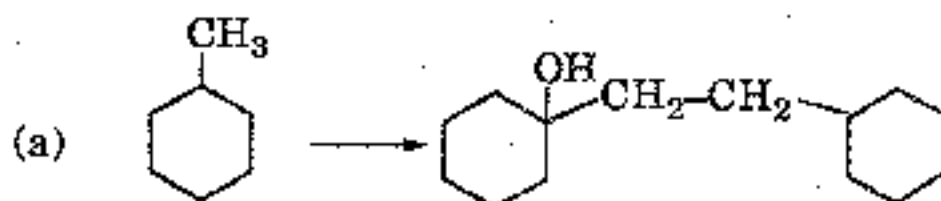


cis-stilbene



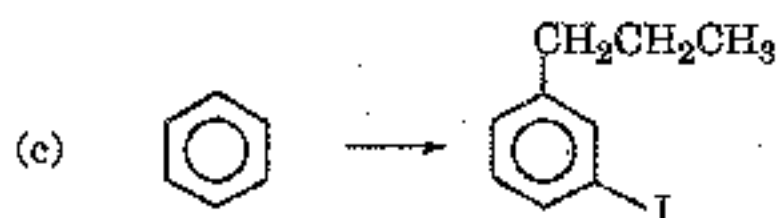
trans-stilbene

- (5%) 15. The water solubility of morphine is only 0.2 g/L, but morphine hydrochloride has a water solubility of 57 g/L. Write equations to show how morphine could be extracted and isolated from opium.
- (12%) 16. Provide necessary reagent(s) or compounds with less than three carbon atoms to complete each of the following multistep transformations.

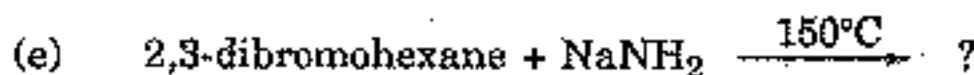
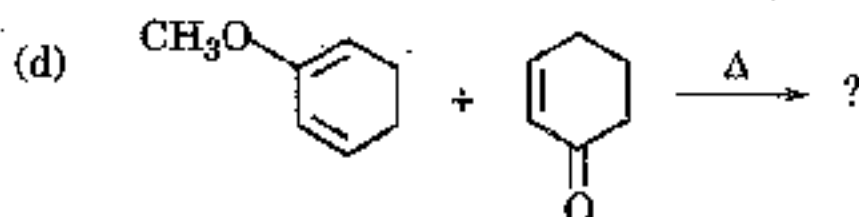
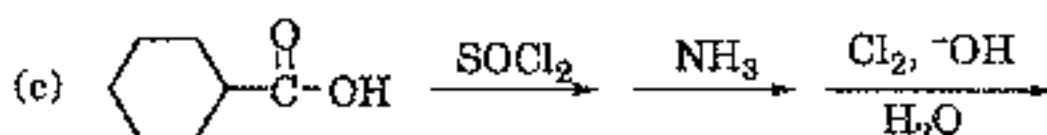
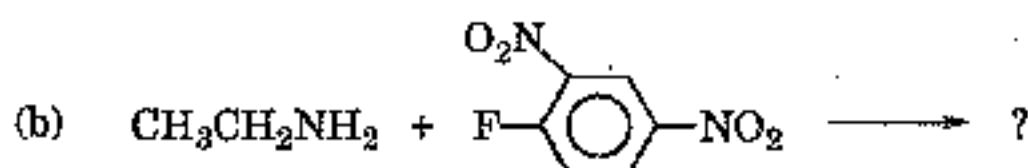
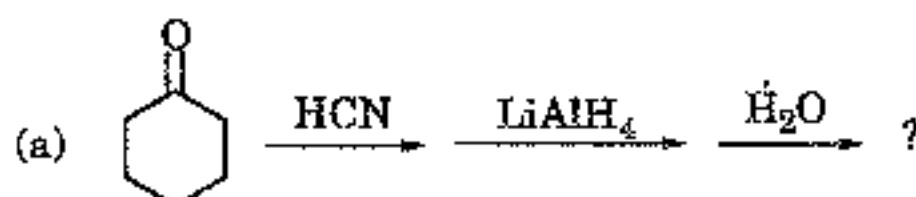


八十四學年度 化學研究 所 化學組 應用化學 組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 共 8 頁第 6 頁 *請在試卷【答案卷】內作答

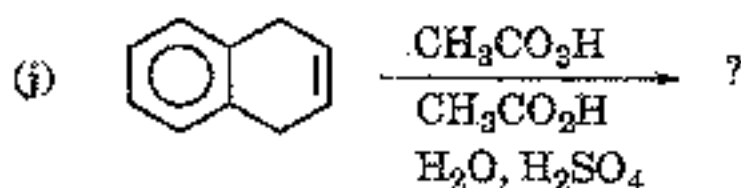
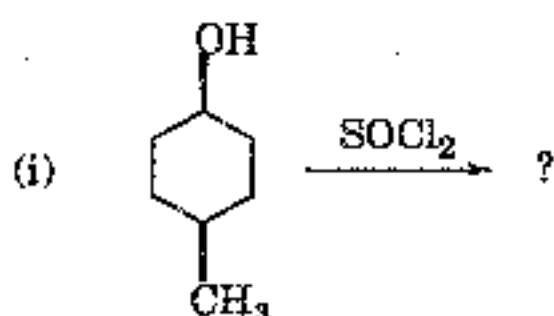
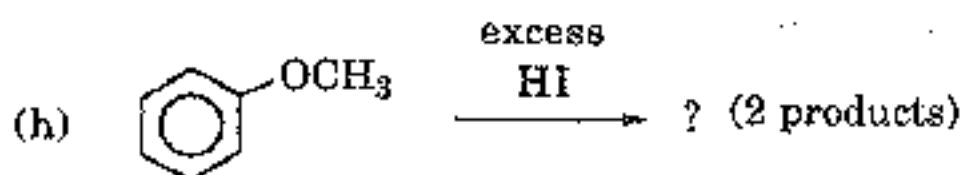
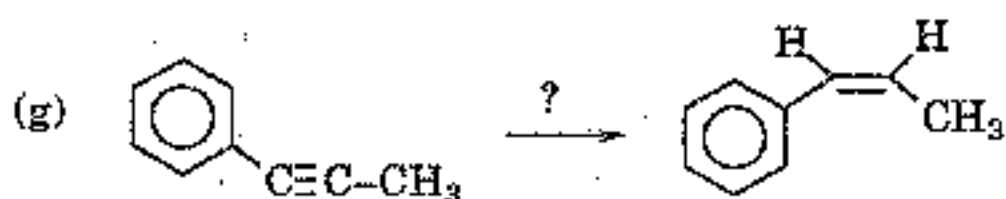
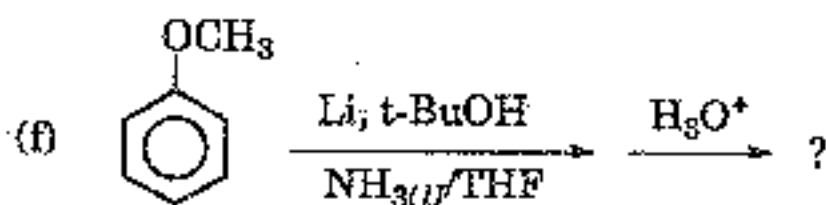


(10%) 17. Give the structure of major product or reagent for each of the following transformations.



八十四學年度 化學研究所 化學組 應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 共 8 頁第 7 頁 *請在試卷【答案卷】內作答



八十四學年度 化學研究

所 化學組
應用化學組碩士班研究生入學考試

科目 無機化學及有機化學 科號 0602 共 8 頁第 8 頁 *請在試卷【答案卷】內作答

- (3%) 18. Provide a stepwise mechanism for the following transformation.

