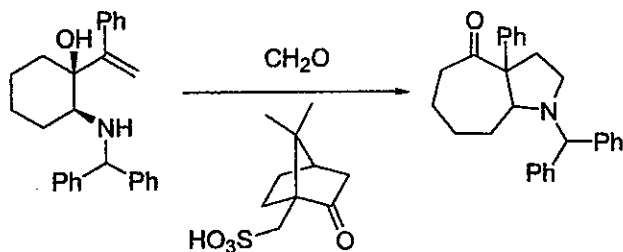
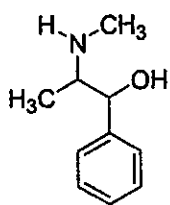


1. Please propose a reasonable reaction mechanism for the following reaction. (8%)



2. (a) How many stereoisomers are possible for the structure listed below? Draw all the stereoisomers and provide IUPAC names for each stereoisomer. (6%)



- (b) Is it possible to differentiate all the stereoisomers by ^1H nuclear magnetic resonance spectroscopy? Please explain it. (4%)

3. Identify the structure of a compound based on the data given below. (8%)

-Empirical formula: $\text{C}_6\text{H}_7\text{S}$

-High resolution electron spray ionization mass spectrum: M^+ (parent mass) = 222.0536.

^1H NMR spectrum (400 MHz, CDCl_3): δ 1.31 (triplet, $J = 7.4$ Hz, 6H), 2.82 (quartet, $J = 7.4$ Hz, 4H), 6.66 (doublet, $J = 3.4$ Hz, 2H), 6.90 (doublet, $J = 3.4$ Hz, 2H)

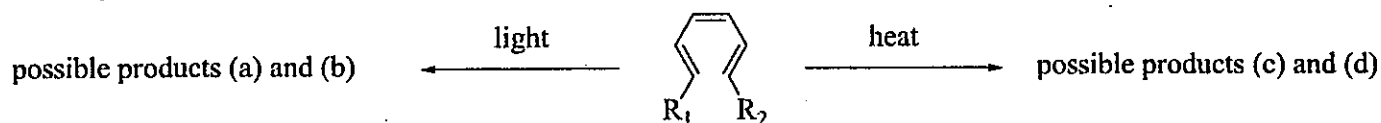
^{13}C NMR spectrum (125 MHz, CDCl_3): δ 15.8, 23.5, 122.7, 123.9, 135.2, 146.2.

4. Tetracene and pentacene are usually more thermal- and photo-sensitive than lower-order acenes, such as benzene, naphthalene, and anthracene. Please account for this experimental observation in terms of frontier orbital. (4%)

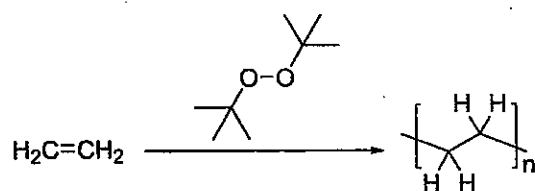
5. Please define bathochromic shift and hypsochromic shift in spectroscopy (4%).

6. A 2.0×10^{-5} M (mol L^{-1}) solution of a compound in a 1.0-cm cuvette has an absorption (A) of 0.5 at $\lambda_{\text{max}} = 400$ nm. Please calculate the extinction coefficient (unit is required) of this compound at $\lambda_{\text{max}} = 400$ nm. (2%)

7. Please give the structures of (a), (b), (c), and (d) in the following equation based on the Woodward-Hoffmann rules. (4%)



8. Polyethylene is prepared according to the equation listed below. Please write down the initiation, propagation, and termination step for this polymerization, respectively. (6%)

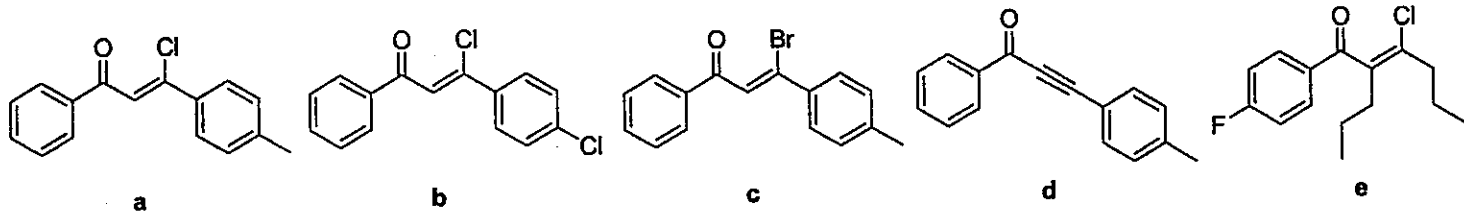


9. Which molecule has greater dipole moment? (a) *cis*-1,2-dichloroethene or *trans*-1,2-dichloroethene (b) methyl bromide or

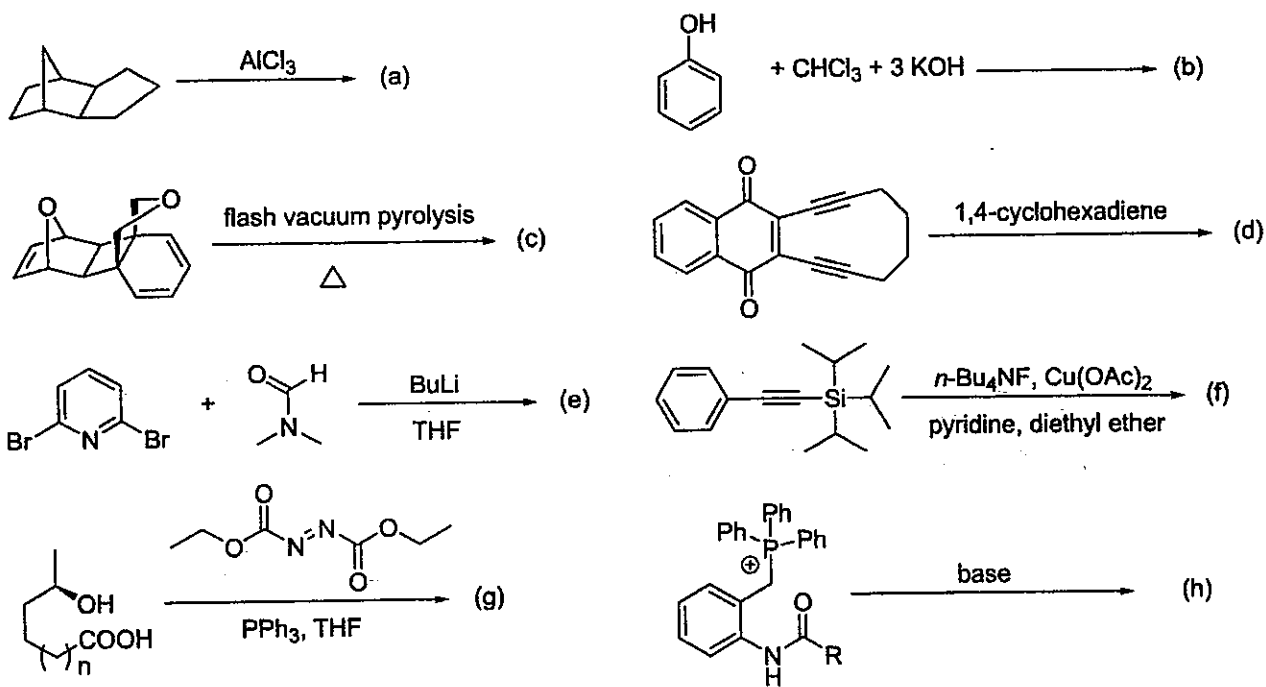
見背面

methyl iodide (c) carbon dioxide or sulfur dioxide (d) chloroform or dichloromethane (e) methane or ammonia. (10%)

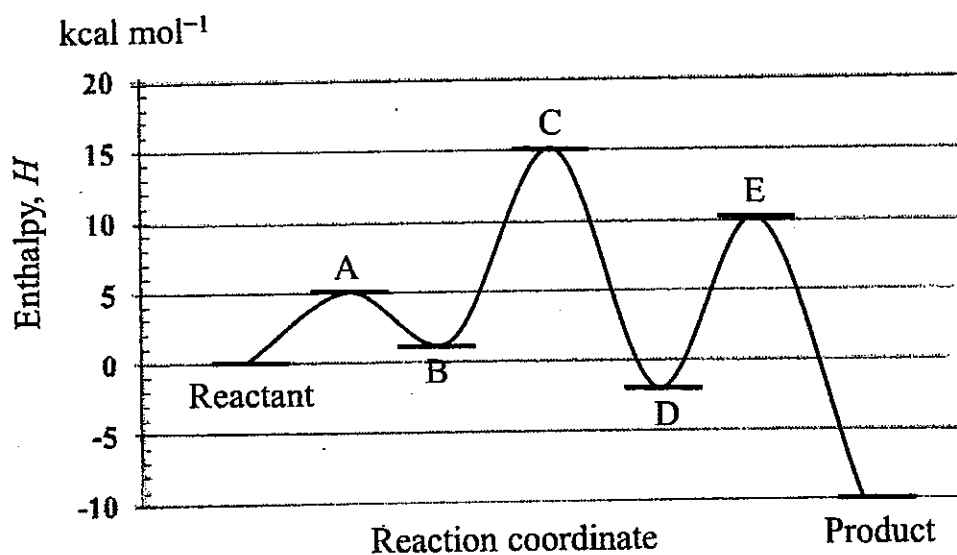
10. A compound has infrared absorption (KBr) peaks of 3059, 2923, 2195, 1643, 1581, 1234, 1164 and 902 cm^{-1} . Which structure (a, b, c, d, or e) matches with the compound best? Give your reasons. (6%)



11. Draw the structure of major product(s) for the following reactions. (32%)



12. An enthalpy (H) diagram starting from reactant to product is illustrated below.



- (a) Based on transition state theory, for A, B, C, D, and E, which states are intermediates and which are transition states? (2%)
- (b) What is the value of activation enthalpy in kcal mol^{-1} for the above reaction? (2%)
- (c) Is this reaction endothermic or exothermic? What is the value of enthalpy of formation in kcal mol^{-1} ? (2%)

試題隨卷繳回