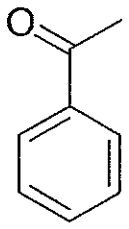
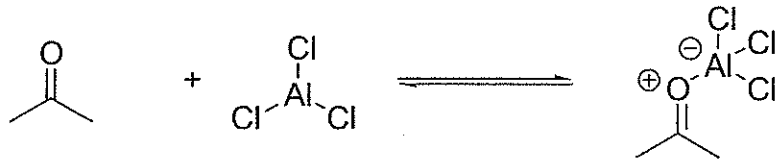
1. (10%) Please draw structures for all constitutional isomers with the C_6H_{14} molecular formula.
2. (8%) Please draw all resonance structures for the following compound.



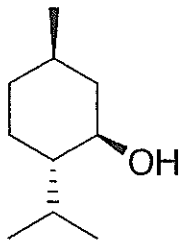
3. (12%) Please identify the Lewis acid and the Lewis base on the left side of each reaction.

(a) 

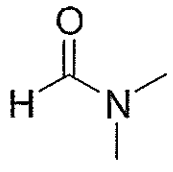
(b) 

(c) 

4. (8%) Please draw two chair conformations of the following compound and indicate which conformation is lower in energy.



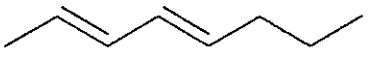
5. (8%) In both ^1H and ^{13}C NMR spectra, *N*,*N*-dimethylformamide (DMF) shows two separate signals for the methyl groups.



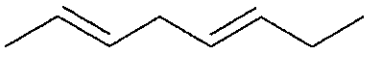
(a) Please account for the nonequivalence of the methyl groups

(b) Would you expect the signals to collapse into one signal at high temperature? Give your reason(s).

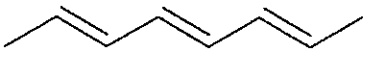
6. (10%) Please deduce the structure of the compound based on the information given below.
Molecular formula: $C_4H_6O_4$
Infrared-ray spectrum: a broad signal between 2500 and 3600 cm^{-1}
^1H NMR spectrum: a singlet at 12.1 ppm with a relative integration of 1 and a singlet at 2.4 ppm with a relative integration of 2.
7. (8%) Please rank the following compounds in order of increasing the wavelength of maximum absorption (λ_{max}).



(a)



(b)



(c)

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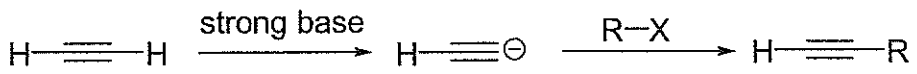
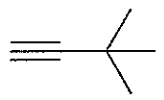
8. (8%) An acetylide ion can serve as a nucleophile in an S_N2 reaction:

X = leaving group

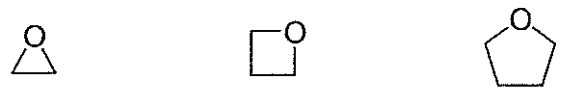


Is it possible that this process can be used to synthesize 3,3-dimethyl-1-butyne? Please give your reason(s).



3,3-dimethyl-1-butyne

9. (8%) The reactivity of methylmagnesium bromide with ethylene oxide, oxetane, and tetrahydrofuran follows the order of ethylene oxide > oxetane > tetrahydrofuran. Please account for the difference in reactivity.



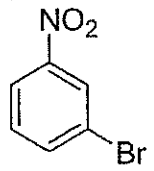
ethylene oxide oxetane tetrahydrofuran

10. (8%) Treatment of the following optically active alcohol with HBr gives a racemic mixture of alkyl bromide. Please explain the stereochemical results for this reaction.

racemic mixture

11. (12%) Please draw structures of major products for the following reactions.

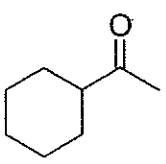
(a)



1) Fe, H^+

2) NaOH

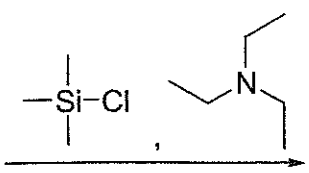
(b)



1) $LiAlH_4$

2) H_2O

(c) R–OH



試題隨卷繳回