EASTERN UNIVERSITY, SRI LANKA

SECOND YEAR FIRST SEMESTER EXAMINATION IN SCIENCE-2021/2022

(FEBRUARY /MARCH 2024)

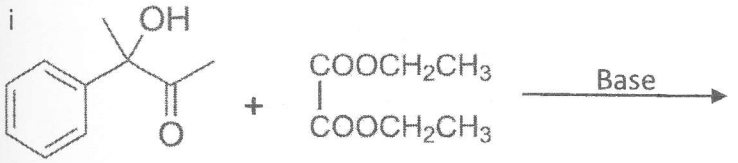
CH2032 ORGANIC CHEMISTRY-I

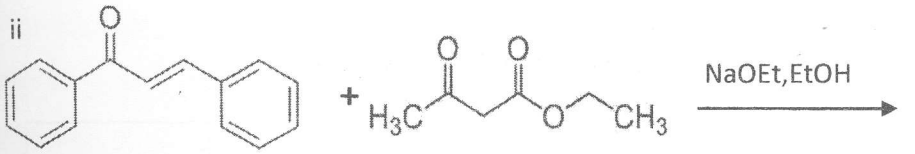
ver **all** questions Time: **two** hours

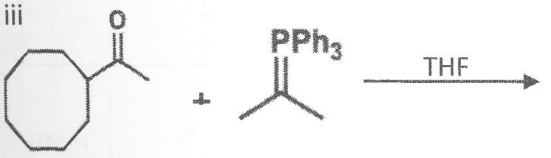
. a) "Aldehyde and ketone react with alcohols under acidic condition to form acetals." *Explain* this statement with a suitable reaction scheme.

(20 Marks)

b) Write down the product and predict a plausible mechanism for the following reactions

i 

ii 

iii 

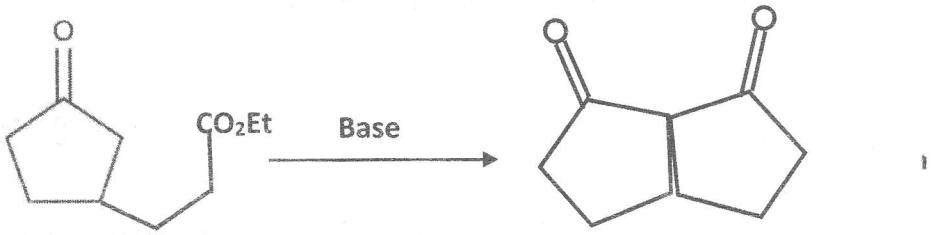
(30 Marks)

Contd.

c) The below reaction is an example for intermolecular crossed Claisen ester condensation. three possible sites for enolate anion formation from structure A, but only one product is in major yield.

i. *Find out* all possible (3) sites for enolate formation in structure **A**.

ii. *Write down* the plausible mechanism for the formation of Hexahydro-1,6-pentalened



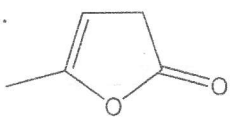
Structure A

Hexahydro-1,6-pentalenedione

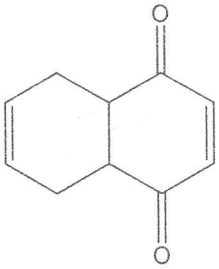
(3

d) *Draw* all the possible enol forms of these carbonyl compounds and *discuss* on the stabili various enols.

i.

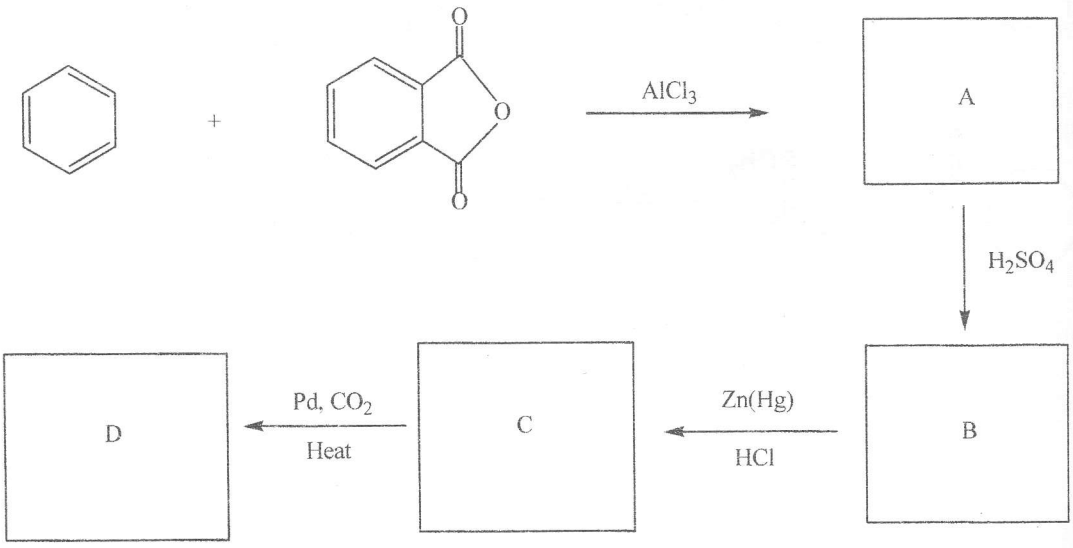


ii.



(2

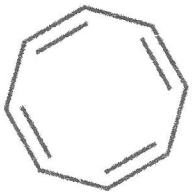
2. a) *Write down* the possible structure for the compounds A, B, C, and D.



(20 Mark

b) i. *What* is *Hückel's* rule for predicting aromaticity?

ii. *Evaluate* each of the following processes applied to cyclooctatetraene, and *explain* whether the species formed is aromatic or not by using the *Hückel's* rule.



Cyclooctatetraene

I) Addition of one more π electron, to give $C_8H_8^-$

II) Addition of two more π electrons, to give $C_8H_8^{2-}$

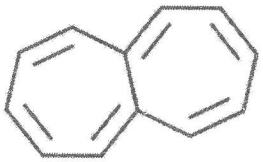
III) Removal of one π electron, to give $C_8H_8^+$

IV) Removal of two π electrons, to give $C_8H_8^{2+}$

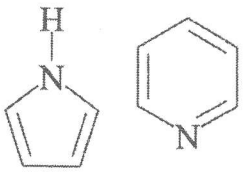
(40 Marks)

Explain the *Craig* rule for poly nuclear benzoid compounds and *apply* the rule to determine the aromaticity of the following heptalene molecule.

(20 Marks)



Both pyrrole and pyridine are nitrogen containing heterocycles that are 6 pi Huckel aromatic, the lone pair on nitrogen plays a different role in each molecule's aromaticity and consequently pyridine is strong base and pyrrole is a weak base. *Describe* the aromaticity and observed basicity for the molecules.



Pyrrole **Pyridine**

(20 Marks)

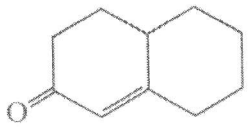
Contd.

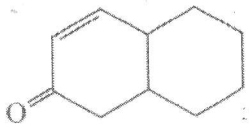
3. a) The UV spectrum of acetone shows absorption maxima at 166, 189, and 279 nm. Using a molecular orbital diagram *explain* what type of transition is responsible for each of these b

(15

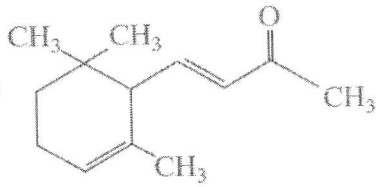
b) *Predict* and *explain* whether UV/visible spectroscopy can be used to distinguish between t following pairs of compounds. If possible, support your answers with λ_{max} calculations.

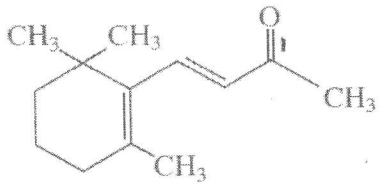
i)



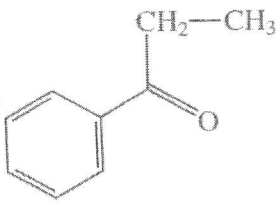


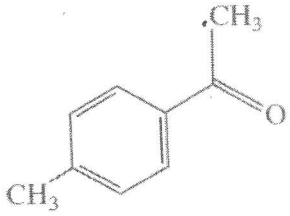
ii)



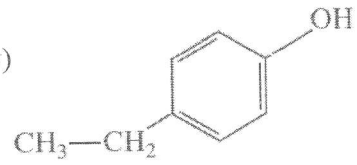


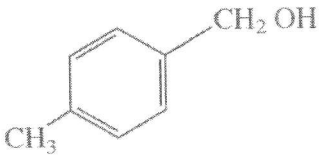
iii)





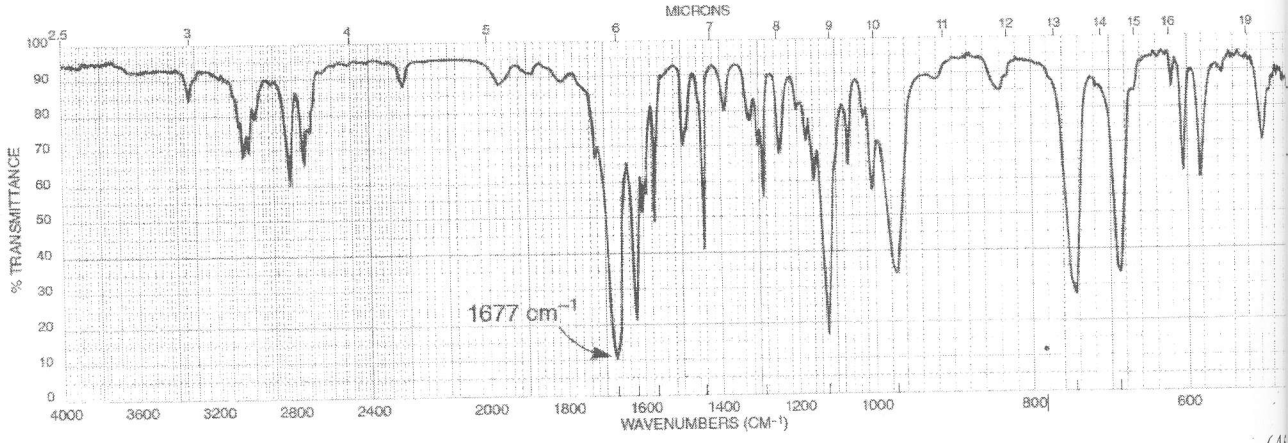
iv)





(40

c) The main constituent of cinnamon oil has the formula C_9H_8O. *Deduce* the structure of this compound from the following infrared spectrum.



(4

4. a) *Calculate* the allowed nuclear spin states for the following atoms.

i) ^{14}N ii) ^{13}C iii) ^{17}O iv) ^{19}F

(20 marks)

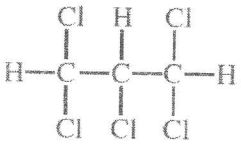
b) A proton has resonance 90 Hz downfield from TMS when the field strength is 1.41 Tesla (14,100 Gauss) and the oscillator frequency is 60 MHz.

i. *Calculate* its shift in Hertz if the field strength is increased to 2.82 Tesla and the spectrometer frequency to 120 MHz.

ii. What will be its chemical shift (δ) in parts per million.

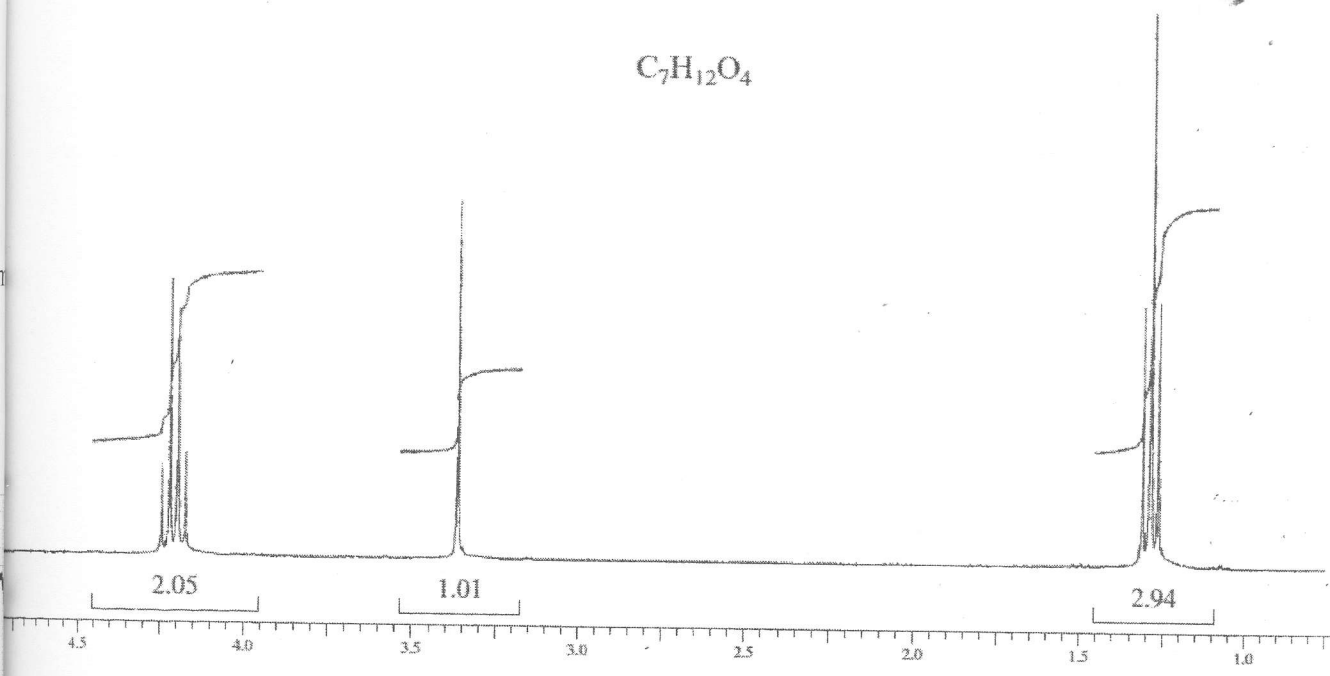
(10 marks)

c) *Predict* the number of signals and their splitting patterns of the ^{1}H-NMR spectrum of the following compound.



(15 marks)

d) The ^{1}H-NMR spectrum for a compound with the formula $C_7H_{12}O_4$ is shown below. The infrared spectrum of this compound has a strong absorption band at 1740 cm^{-1} and several strong bands in the range 1333 to 1035 cm^{-1}. *Interpret* the spectral data and *draw* the structure of this compound.



(55 marks)

&&&&&&&&&&