Reg. No. | | | | | | | | | |

Ques No.	Max.	Marks
1	25	
2	30	
3	45	
Total	100	

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. Degree Programme

and Stand Alone Courses in Science - 2014/2015

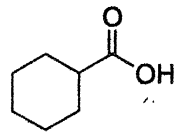
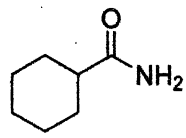
CMU2221/CME4221 - Organic Chemistry 1

CONTINUOUS ASSESSMENT TEST 1

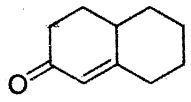
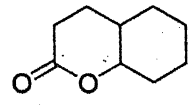
Saturday 07th February 2015 2.30 p. m.–3.30 p. m.

ANSWER ALL QUESTIONS

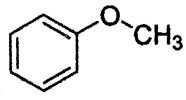
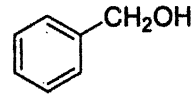
1. (a) Giving one reason state how you would distinguish between the compounds in the following pairs using IR spectroscopy.

(i)  and 

A B

(ii)  and 

C D

(iii)  and 

E F

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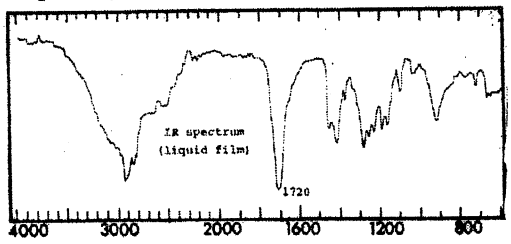
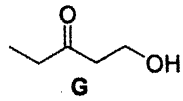
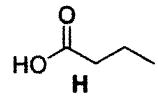
(15 Marks)

(b) Which of the given structures **G** – **J** fits best to the IR spectrum below? ☐
Explain your answer.

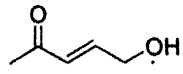




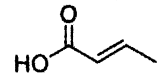
G



H



I



J

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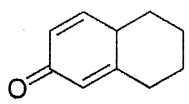
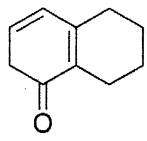
(10 Marks)

Reg. No. | | | | | | | | | |

2. (a) Which compound in each of the following pairs shows higher λ_{max} in UV-Vis spectroscopy? Give your reason.

(i)  and 

K L

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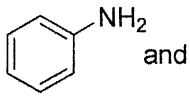
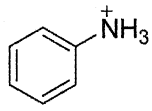
(ii)  and 

M N

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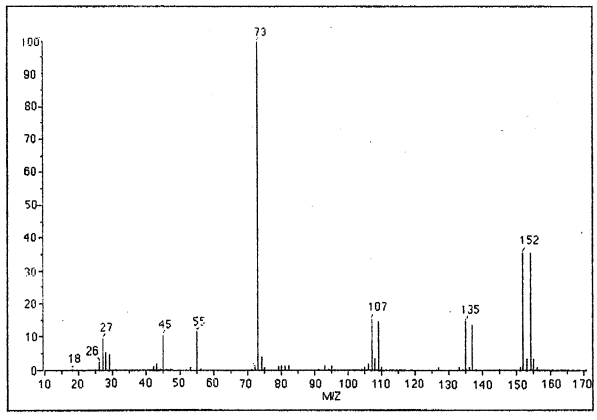
(10 Marks)

(b) Following is the mass spectrum of a monohalogenated organic compound. What is the halogen present in this molecule? Explain your answer.



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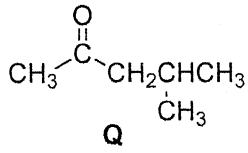
(10 Marks)

(c) Compound **Q** showed a peak at m/z 58 in its mass spectrum among other peaks. Showing the fragmentation pathway, postulate the structure of the fragment ion responsible for this peak.



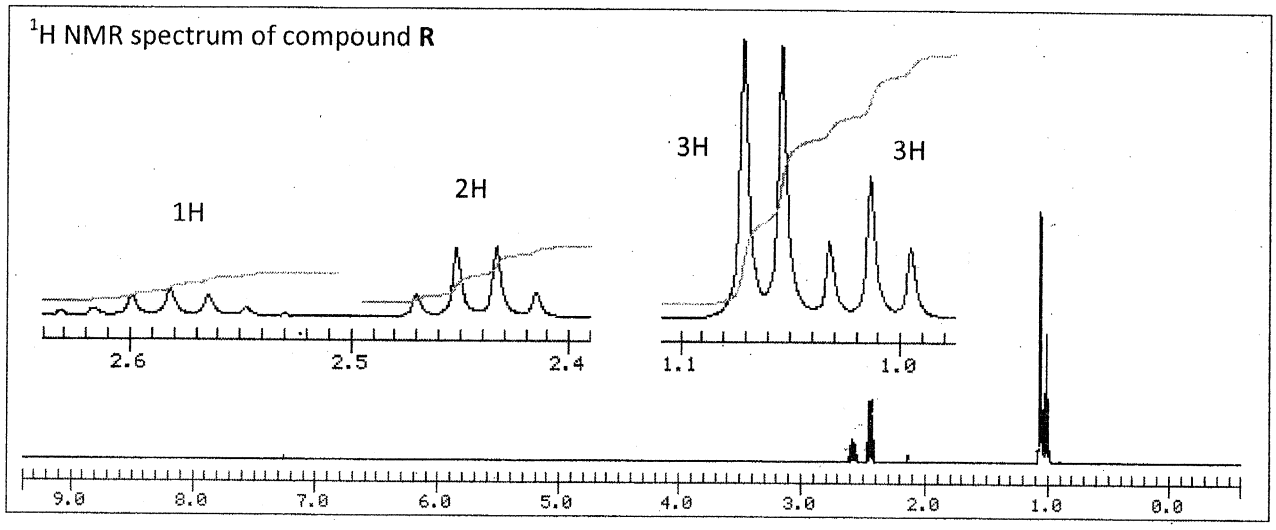
Q

m/z 58

(10 Marks)

Reg. No. | | | | | | | | | |

3. ^{1}H NMR spectrum of compound **R** ($C_6H_{12}O$) along with some useful expansions is given below. The IR spectrum of **R** showed a strong absorption at 1712 cm^{-1} among other peaks while no absorptions are observed above 2900 cm^{-1}.



(a) What is the possible functional group present in **Q?**

What information you get from the statement, "no absorptions are observed above 2900 cm^{-1}"? .....

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How many different types of protons are there in compound **Q**? | |

Label them using A, B, C, D etc.

(b) What are the different spin systems present in this molecule?

(c) Deduce the structure of compound **H** and assign the ^{1}H NMR signals to the proposed structure.

(45 Marks)

Reg. No. | | | | | | . | | | |

Name :.....

Address :.....

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B.Sc. Degree Programme and Stand Alone Courses in Science – 2014/2015
CMU2221/CME4221 – Organic Chemistry 1
CAT 1- Answer Guide

1. (a) (i) One of the following answers is acceptable.
   - Compound **A**, gives a broad absorption band little above 3000 cm^{-1} due to –OH stretching. Such a broad band in this region is not given by **B**.
   - Compound **B**, gives two sharp peaks due to -N-H stretching in the region just above 3000 cm^{-1}. No such two sharp peaks in the IR spectrum of **A**.
   - Compound **A**, gives a broad absorption band in its IR spectrum little above 3000 cm^{-1} due to –OH stretching while compound **B** gives two sharp peaks due to -N-H stretching in the same region.

   (ii) One of the following answers is acceptable.
   - Both compounds have -C=O groups, which show absorption around 1700 cm^{-1}. But compound **C** only has a conjugated carbonyl group. Therefore it shows absorption at a lower frequency than **D**.
   - Sharp absorption band in the fingerprint region around 1200 cm^{-1} due to -C-O stretching is observed in the spectrum of **D**. This is absent in the spectrum by **C**.

   (iii) A broad absorption band above 3000 cm^{-1} is observed due to –OH stretching in the IR spectrum of **F**. But there is no such band in this area in the IR spectrum of **E**.

   (b) Structure **H**

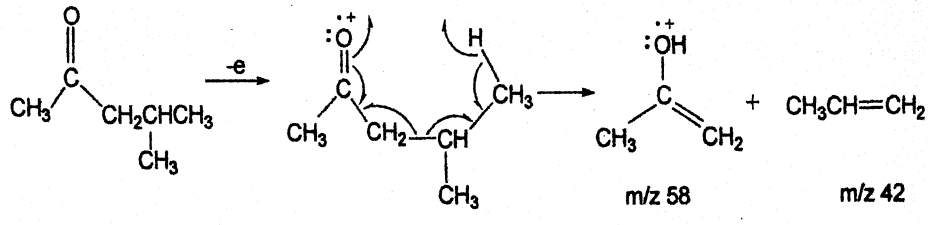
   The prominent broad absorption band above 3000 cm^{-1} indicates absorption by –O-H stretching overlapping with –C-H stretching by an acidic -OH group (-OH of a -COOH group). Therefore the compound could be either **H** or **J**. If it is **J**, it should show absorption due to -C=C- stretching around 1600 cm^{-1} in addition to -C=O absorption band around 1700 cm^{-1}. Since it is not present in the spectrum, the compound should be **H**.

2. (i) **L** - Both compounds are α, β unsaturated ketones (or enones). But in compound **L** has an extra double bond in conjugation. Hence λ_{max} is higher in **L** than **K**.

   (ii) **M** - Compound M only has a lone pair of electrons on nitrogen which can be conjugated with the benzene ring. Due to conjugation, **M** shows higher λ_{max} than **N**.

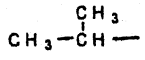
   (b) Compound has two lines each for M^+ and two other fragment ions in its mass spectrum. Therefore compound contains a halogen which has isotopes. Out of Cl and Br, halogen which shows 1:1 isotope abundance is Br. (Cl shows 3:1 isotopic abundance). Therefore, the halogen present in the compound is Br.

   (c)



McLafferty Rearrangement

3. (a) –C=O / carbonyl group is present. -OH group is absent. 4 (four) different types of protons/hydrogens are present in compound **R**. Chemical shifts (δ) of A: 2.58 ppm, B: 2.44 ppm, C: 1.06 ppm, D: 1.01 ppm

   (b) $-CH_2CH_3$ and 

   (c)