DEPARTMENT OF CHEMISTRY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SECOND SEMESTER TEST 2018/2019 SESSION

COURSE CODE: CHM 323 **COURSE TITLE:** Applied Spectroscopy

TIME ALLOWED: 2 Hours

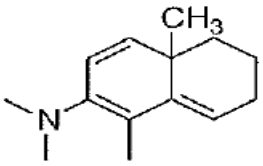
INSTRUCTIONS: Answer All Questions

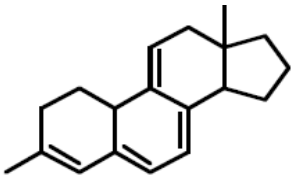
1ai) Define and differentiate between auxochromes and chromophores.

ii) Exemplify and explain how auxochrome shifts absorption wavelength of a compound.

b) Given the following:

R- (Alkyl Group)	+5 nm
RO- (Alkoxy Group)	+6 nm
X- (Cl- or Br-)	+10
RCO_2- (Acyl Group)	0
RS- (Sulfide Group)	+30 nm
R2N- (Amino Group)	+60 nm
C=C (Double Bond)	+30 nm
C_6H_5 (Phenyl Group)	+60 nm

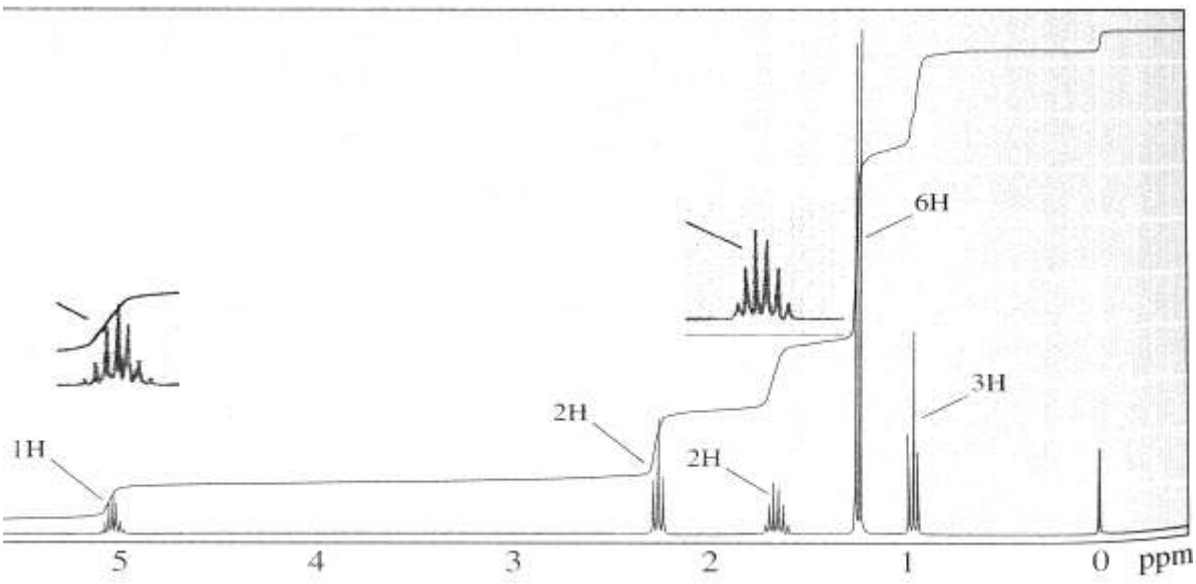




i. ii

Calculate the total λ maximum for the above compounds.

2a) The ^1H NMR spectrum for a compound with the molecular formula $C_7H_{14}O_2$, is shown below:



Determine the structure of this compound. Show your analysis.

b) Express the multiplet splitting patterns expected for common fragments of the following compounds in NMR:

i CH_3CH_2X

ii $Br - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{CH}}$

c) Briefly state the principles behind NMR Spectroscopy

3ai)What is optical rotation and where do they occur? ii) With the aid of a schematic diagram explain how polarimeter operates?

bi)What is Specific Rotation $[\alpha]_D$?

bii) A solution of 2.0 g of (+)-glyceraldehyde in 10.0 mL of water was placed in a 100 mm polarimeter tube. Using the sodium D line, a rotation of 1.74° was observed at 25°C. Calculate the specific rotation of (+)-glyceraldehyde.

ci) How do we express optical purity?

ii) (-)-2-butanol has a specific rotation of - 13.5°, while the specific rotation of (+)-2-butanol is +13.5°. A mixture containing (+) and (-)-2-

butanol has an observed rotation of – 8.55°. Does the mixture contain more (+) or more (-)-2-butanol? Calculate the optical purity of the mixture.

di) What are enantiomers?

ii) What is enantiomeric excess (e.e.)?

iii) Calculate the e.e. of a mixture containing 25% (+)-2-butanol and 75% (-)-2-butanol.

4a) What is Raman Spectroscopy?

b) What is the difference between Raman Spectroscopy and Infrared Spectroscopy?

c) With aid of a schematic diagram, write a short on the basic principle and theory of Raman Spectroscopy to support your explanation.

di) What is Raman effect? ii) With aid of energy level diagrams explain how Raman Scattering and states involved in Raman signal work?

e) Outline five uses of Raman Spectroscopy