

OLABISI ONABANJO UNIVERSITY AGO-IWOYE
2012/2013 RAIN SEMESTER UNIVERSITY EXAMINATIONS
B.Sc/B.Ed DEGREE EXAMINATIONS; CHEMICAL SCIENCES

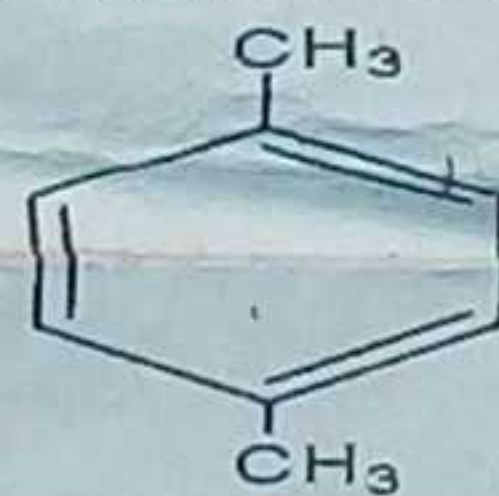
CHM 312: APPLIED SPECTROSCOPY

MAY, 2014

TIME ALLOWED: 1½ h.

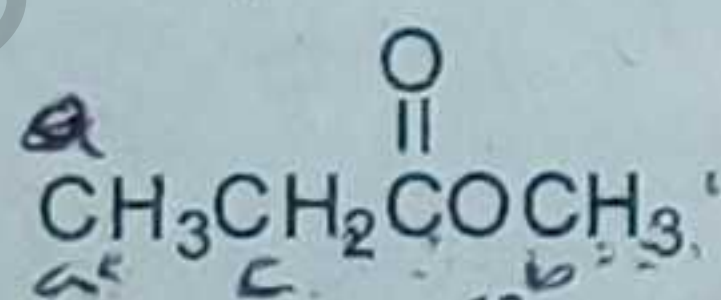
INSTRUCTION: ATTEMPT ALL QUESTIONS

- Match the mass spectra given with the compounds: 2-methoxy-2-methylpropane = , 1-methoxybutane = , 2-methoxybutane = . (6 mks).
- What would be the base peaks for each of these ketones (i) $\text{CH}_3\text{CH}_2\text{C}(=\text{O})\text{CH}_2\text{CH}_3$ = (4 mks).
(ii) $\text{CH}_3\text{C}(=\text{O})\text{CH}_2\text{CH}_2\text{CH}_3$ = (4 mks).
- Mention any 4 components of Electromagnetic spectrum (4 mks).
- Mention 2 uses of Mass spectrometry (2 mks).
- What is the wavelength of radiation that has a wavenumber of 200 cm^{-1} ? (2 mks).
- In alcohols, an important fragmentation occurs in which 2 bonds are broken. What is the product formed and its m/z value? (2 mks).
- How would you distinguish between the mass spectra of an alkyl chloride and an alkyl bromide? (2 mks).
- What types of bonds are broken preferentially in a mass spectrometry experiment? (2 mks).
- What is the wavenumber of a radiation that has a wavelength of $4\mu\text{m}$? (2 mks).
- _____ determines the intensity of the absorption band associated with an IR vibration. (2 mks).
strength of bond the mass of bonded atom
- The energy required to stretch a bond depends on _____ and _____. (2 mks)
- Alcohols and ethers both show a C-O stretch at about 1050 cm^{-1} while an acid shows a C-O stretch at about 1250 cm^{-1} . Explain (2 mks).
- The C-O stretch of an ester shows at about 1250 cm^{-1} and 1050 cm^{-1} . Explain. (2 mks)
- Given that C-H stretches were observed at about (i) 2900 cm^{-1} , (ii) 3300 cm^{-1} , (iii) 3100 cm^{-1} . Which of this absorption corresponds to an sp , sp^2 and sp^3 hybridized carbon? (2 mks)
- Calculate the operating frequency of a ^1H NMR spectrometer whose magnetic field is 14.092, given that $\hbar = 3.1416$ and $\gamma = 2.675 \times 10^8\text{ T}^{-1}\text{s}^{-1}$ (3 mks)
- The frequency of an NMR signal depends on _____ (2 mks)
strength magnetic field experienced by the nucleus (i.e. difference in E Coe) b/w α & β spin
- How many ^1H NMR signals would you expect to see for each of these compounds?



18. (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ (ii) $\text{CH}_3\text{CH}_2\text{OCH}_3$ (iii)  (6 mks)

19. Label each of the protons in this compound and clearly show their splitting and multiplicity pattern.



$\text{H}_a \rightarrow \text{N}+1$
 $2+1=3$

$\text{H}_b = 3\text{H}$, singlet

$\text{H}_a = 3\text{H}$, triplet

20. How many signals are in the ^{13}C NMR of the compound in no. 19 above? Identify the Carbon signals at the highest and lowest frequency? (3 mks)

21. The group of atom(s) responsible for colouration in molecule or part of a molecule that absorbs ultra violet or visible light is _____ (2 mks)
chromophore

22. _____ when attached to a chromophore alters the λ_{max} and the intensity of absorption (2 mks)
auxochrome

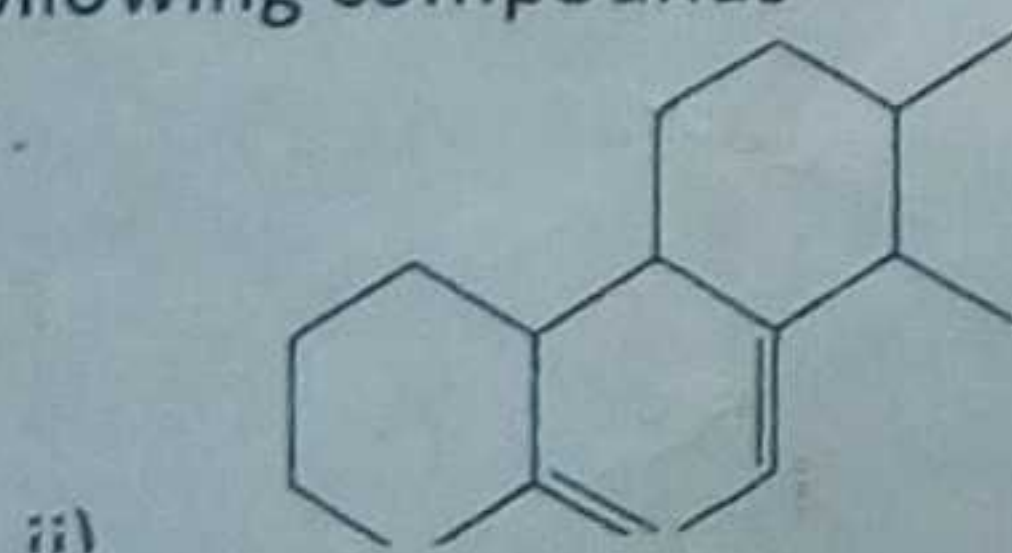
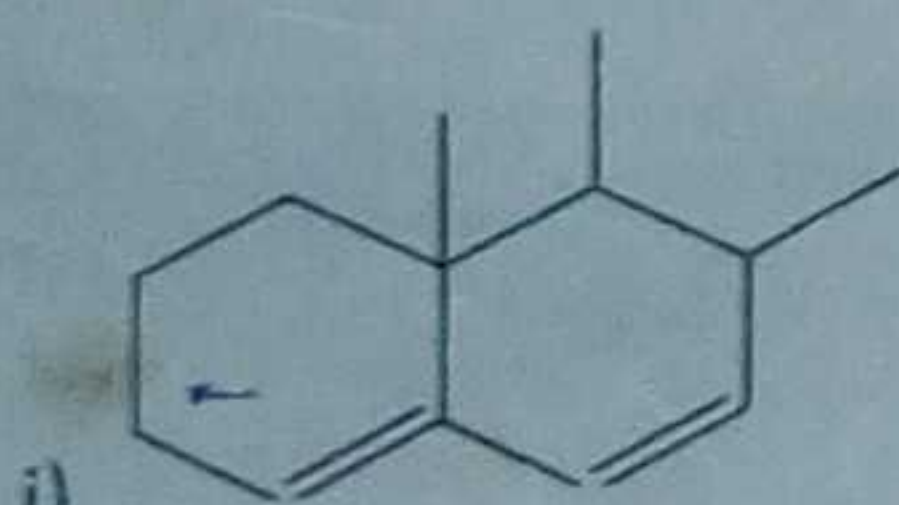
23. Shift of absorption to a longer wave length is _____ (2 mks)
bathochromic

24. The effect that leads to the increase in intensity of absorption is _____ (2 mks)
hyperchromic

25. _____ shifts absorption to a shorter wave length. (2 mks)
hypsochromic effect shift

26. A solution of 4-methyl-3-penten-2-one in ethanol shows an absorbance of 0.52 at 236 nm in a cell with a 1 cm light path. Its molar absorptivity in ethanol at that wave length is $12,600\text{ M}^{-1}\text{ cm}^{-1}$. What is the concentration of the compound? (2 mks)

27. Calculate the λ_{max} for the following compounds



$\frac{25}{100}$

$\frac{25}{125.1100}$

5.0

5.04

$A = \frac{ecl}{c}$

$\frac{12,600}{0.25 \times 1}$

$c = 12,600$

$\frac{12,600}{0.25}$