



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE
EXPRESS WAY, JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2024 1 EXAMINATION

COURSE CODE: CHM 391
COURSE TITLE: PRACTICAL CHEMISTRY V – INORGANIC AND ANALYTICAL
CREDIT UNIT: TWO (2)
TIME: 2 HOURS
INSTRUCTION: Answer question one and any other two questions.

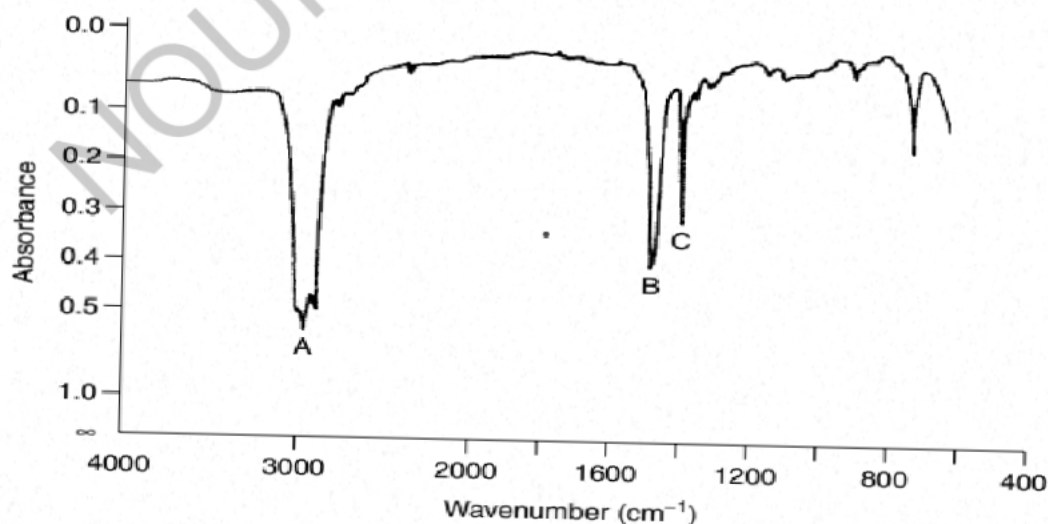
Question one

1a) Define the following terms

- i. Auxochrome
- ii. Chromophore
- iii. Bathochromic shift
- iv. Hypsochromic shift
- v. Hyperchromic effect
- vi. Hypochromic effect **12mks**

1b) Using equation only, defines beer-lamberts law and defines the terms in the equation. **6mks**

1c) Examine the infrared spectrum of nonane shown in the figure below and with the help of the attached table, describe the vibrations corresponding to the bands marked A, B and C. **6mks**



CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS

Class of compounds	Absorption cm^{-1}	Intensity	Assignment	
Alkanes and Akyls	2850 – 3000	s	C – H stretch	
	1450 – 1470	s	C- H bend	
	1370 – 1390	m	CH_2 C – H bend	
	1365 +1395	m	$-\text{CH}(\text{CH}_3)_3$ bend	
	Two bands 715 - 725	w	$-(\text{CH}_2)_n$ bend	
	Alkenes	3020-3140	w-m	=C-H Stretch
1640-1670		vw-m	C=C Stretch	
910+990		m+s	=C-H bend	
Two bands 885-895		s	=C-H bend	
665-730		m-s, broad	=C-H bend	
960-980		s	=C-H bend	
790-840		s	=C-H bend	
Alkynes		3265-3335	s	=C-H Stretch
	2100-2140	m	C=C Stretch	
	610-700	s	=C-H bend	
	2190-2260	vw-w	C=C Stretch	
Ethers	1085-1150	s	C-O-C Stretch	
	1020-1075 and 1200-1275 (Two bands)	m	=C-O-C sym and asym stretch	
	Aldehydes	2700-2725	m	H-C=O Stretch
		1720-1740	s	C=O Stretch
1685-1710		s	C=O Stretch	
Carboxylic acids	2500-3500	s bend	O-H Stretch	
	1710-1715	s, broad	C=O Stretch	
	1680-1710	s, broad	C=O Stretch	
Alcohols	3300 – 3400	s, broad	O – H stretch	
	1125 – 1205	m - s	C – O stretch	

Intensity abbreviations: vw = very weak, w = weak, m = medium, s = strong, vs = very strong

1d) A 1.0% (wt/vol) solution of hexanol ($\text{C}_6\text{H}_{13}\text{OH}$) has an infrared absorbance of 0.37 at 3660 cm^{-1} in a 1.0 mm cell. Calculate its molar absorptivity at this wavenumber. **3mks**

1e) Write short note on the working principle of colorimetry. **3mks,**

Question two

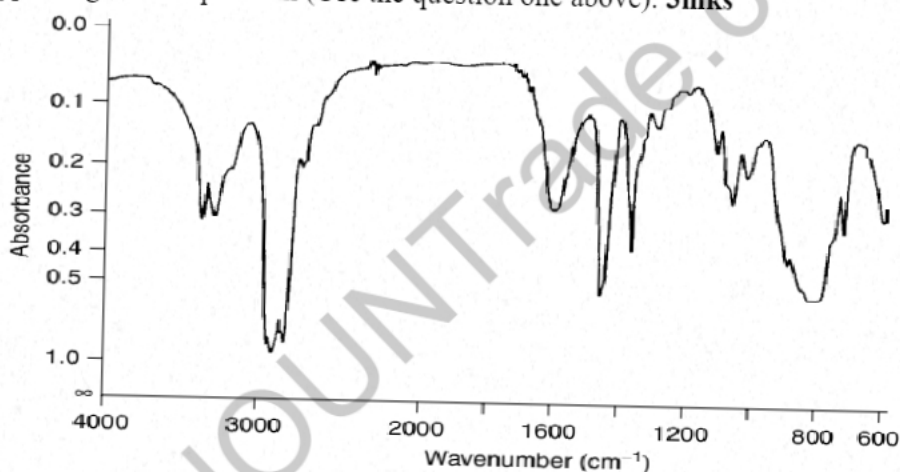
- 2a) Explain the principle of infrared spectroscopy, **10mks**
2b) Discuss the following as applied to gravimetric analysis (i) Precipitation **10mks**

Question three

- 3a) Give a brief explanation of each of the following as related to AAS sample preparation;
- Wet ashing
 - Fusion
 - Dry ashing
 - Microwave dissolution. **12mks**
- 3b) It is rarely practicable to directly weigh out the required reference substance in the preparation of standard for AAS analysis, briefly explain what you must do to prepare appropriate reference standard accurately. **4mks**
- 3c) Enumerate the types of chemical reactions that constitute potentiometric titration. **4mks**

Question four

- 4a) Below figure shows the infrared spectrum of a liquid film of hexylamine. Assign the major bands appearing in this spectrum (Use the question one above). **3mks**



- 4b) State the difference between the absorbance of a blank solution and absorbance of a sample solution. **2mks**
- 4c) Highlight two uses each of the following: UV-Visible spectroscopy and Precipitation gravimetry? **8mks**
- 4d) In detecting group I cations, the addition of NH_4OH , a solution of AgCl and Hg_2Cl_2 can be separated. Using a balanced equation only, show the reactions. **4mks**
- 4e) Explain the reason for lengthy time of digestion of crystalline precipitates **3mks**

Question five

- 5a) Describe how wavelength of maximum absorption (λ_{max}) is determined? **8mks**
- 5b) Discuss the fundamental vibrations that occur in infrared spectroscopy. **6mks**
- 5c) List the advantages of potentiometric titrations over classical visual indicator methods. **6mks**

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