



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE
EXPRESS WAY, JABI - ABUJA.

FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2025_2 EXAMINATIONS.

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.) The first step in carrying out a UV – Visible spectroscopic analysis of a sample is to know the wavelength of maximum absorption of the sample, in a situation whereby you do not know the wavelength of maximum absorption of the sample, describe briefly how you would determine the wavelength of maximum absorption of a sample. (9½ marks)

1bi. Below is an infrared spectrum and Group frequency or Correlation table. Identify the prominent peaks and use the table to correlate the identified peaks with the functional groups they represent. (6 marks)

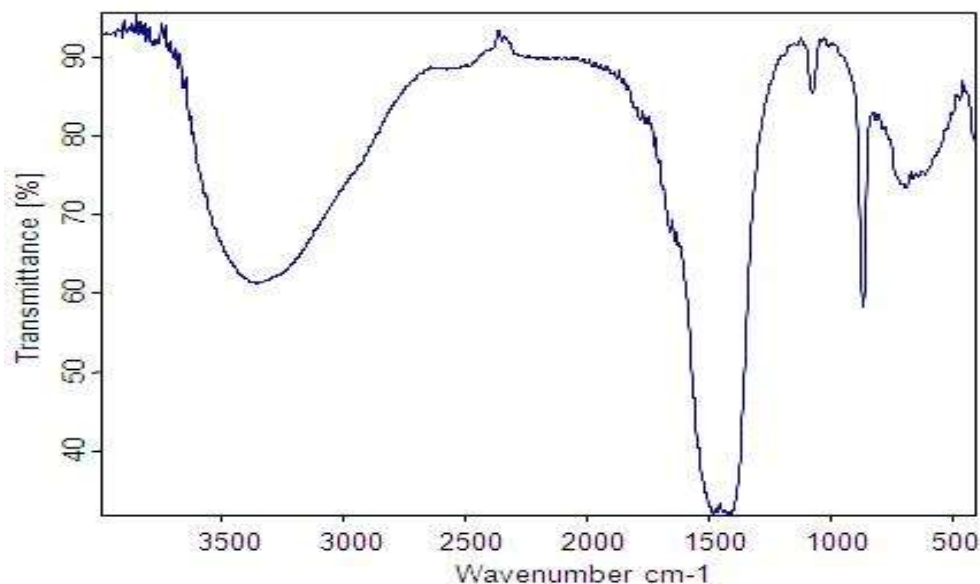


Table of Correlations of various types of vibrations and group frequencies

Group	Vibration	Class of molecule	Group frequencies (cm ⁻¹)
C – H	stretch	Alkanes, alcohols	2800 - 3000
C – H	stretch	Aldehydes	2700 - 2900
C – H	stretch	Alkenes	3010 - 3095
O – H	stretch	Alcohols, phenols	3200 - 3600
O – H	stretch	Acids	2500 - 3000
O – H	bend	Alcohol, phenol	1260 - 1410
N – H	stretch	Amines	3300 - 3500
C = C	stretch	Alkenes	1620 - 1680
C = O	stretch	Aldehydes	1720 - 1740
C = C	stretch	Alkynes	2100 - 2140
C = N	stretch	Nitriles	2000 - 2500
C = O	stretch	Ketones	1705 - 1725
C-H	bend	1,2,4-trisubstituted	860-900
C-H	bend	1,3-disubstituted	860-900
C-H	bend	1,4-disubstituted	790-830
C-H	bend	1,2,3,4-tetrasubstituted	790-830
C-H	bend	1,2,3-trisubstituted	760-800
C-H	bend	1,2-disubstituted	735-775
C-H	bend	Monosubstituted	730-770
		benzene derivative	680-720

1bii. What class of molecule does the identified function groups belong to. (2½ marks)

1c.) Of what use is potentiometric titration? (4 marks)

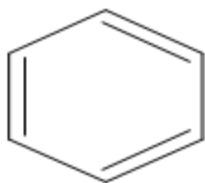
1di. A precipitate's solubility can be increased or decreased by the type of solvent used to wash the precipitate after it forms. With reason(s) to justify your answer, state the kind of solvent which is appropriate for washing a precipitate. (4 marks)

1dii. Describe briefly how an infrared spectrum can be obtained. (4 marks)

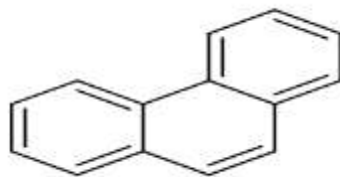
QUESTION TWO

2ai) Study the molecules below, which of them will absorb UV -Visible radiation the most, hence give the highest UV- Visible wavelength among the three. Give reason(s) for your answer.

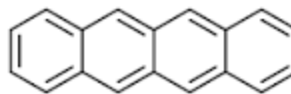
(4 marks)



Benzene



Phenanthrene



Naphthalene

2aii) Highlight six (6) significance of alkalinity (6 marks)

2b) Describe briefly the procedure of determining alkalinity of a water sample by Phenolphthalein alkalinity method.

(10 marks)

QUESTION THREE

3a) Explain briefly how to carry out potentiometric titration. (9 marks)

3bi) What is the importance of selective precipitation in the qualitative analysis of metal cations? (5 marks)

3bii) What are the common reagents used to separate Group I and Group II cations, and how do they work? (6 marks)

QUESTION FOUR

4a) Explain in five sentences the process of atomization in AAS (7½ marks)

4b) Highlight five applications of AAS in different fields (5 marks)

4c) What is wet ashing in preparing samples for AAS analysis. Hence list one acid that can be used for wet ashing of inorganic substances, silicates and organic complexes respectively (7½ marks)

QUESTION FIVE

5a. Write short note on colorimetry. (6 marks)

5bi. Expatriate on colour formation of a substance to be analyzed by colorimetry. (6 marks)

5bii. What is the basic procedure of carrying out a colorimetric determination? (8 marks)