NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY, JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF PURE AND APPLIED SCIENCES
JUNE/JULY 2017 EXAMINATION

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

QUESTIONONE

1a)Outline and explain briefly the steps involved in gravimetric analysis. 12 marks

1b)Calculate the total alkalinity of a 100 ml water sample titrated with 0.03M H_2SO_4, using the values obtained for the determination of total alkalinity in a water sample presented below.

NO of titration	Volume of sample (mL)	Initial burette reading	Final burette reading	Volume of Sulphuric (mL)
1	100	0.00	6.40	6.40
2	100	0.00	6.50	6.50
3	100	0.00	6.50	6.50

5 marks

1ci)Mention the uses of the following:

I. Gravimetric analysis
II. Potentiometric titration
III. UV- Visible spectroscopy
IV. Colorimetry
V. Infrared spectroscopy
VI. Atomic absorption spectroscopy

6 marks

1cii) How would you set the absorbance of UV-Visible spectrophotometer at zero (0)?
2 marks

QUESTION TWO

2a) Assuming you determined the absorbance readings of a 0.008M analyte at different wavelengths starting from 400nm to 600nm at 20nm interval and obtained the data presented below. Determine the wavelength most sensitive to the analyte i.e. *λmax* (maximum wavelength) using the obtained values.

S/N	Wavelength (nm)	Absorbance
1	400	0.18
2	420	0.30
3	440	0.44
4	460	0.57
5	480	0.90
6	500	1.10
7	520	1.23
8	540	1-00
9	560	0.88
10	580	0.52
11	600	0.36

(10 marks)

2b) Use Beer's law to calculate molar absorptivity ε for the analyte, given the cell width (path length *l*) to be 1 cm.5 marks

QUESTION THREE

3a) In order to determine the concentration by atomic absorption spectroscopy (AAS) of vanadium in a vegetable sample obtained from a farm polluted with crude oil spill, standard solutions of vanadium was prepared and their absorbance read at 525 nm. If the following data were obtained;

Standard	Concentration (mol/L)	Absorbance
1	0.00008	0.124
2	0.00016	0.239
3	0.00040	0.614
4	0.00080	1.160

Determine the concentration of vanadium in the vegetable sample whose absorbance is 0.56.
11 marks

3b)Enumerate the procedure of determination of concentration of an analyte by colorimetry.4 marks

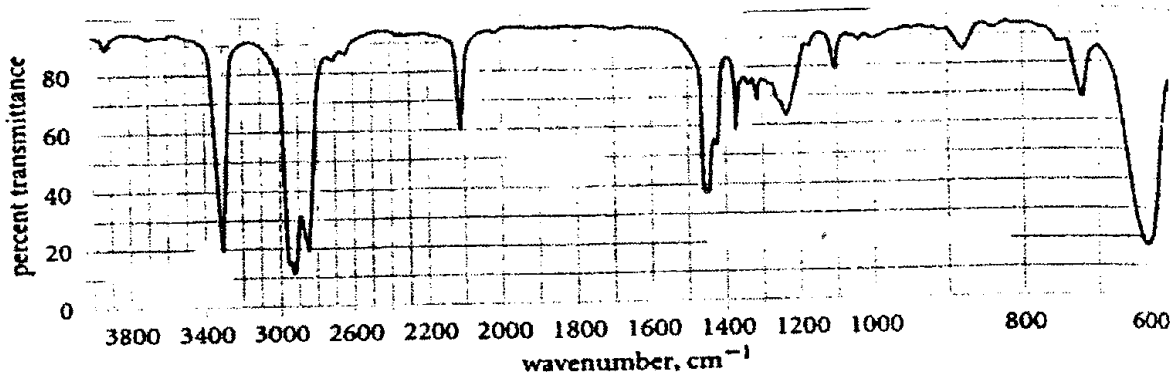
QUESTION FOUR

4a) Use a schematic diagram to show the procedure for the separation and identification of a metal cation in a given sample. 10 marks

4b) Differentiate between qualitative analytical groups and groups of the periodic table.5 marks

QUESTION FIVE

5a) Use the table of characteristic infrared absorption bands of organic functional groups provided to identify the functional groups present in an organic molecule whose IR spectrum appear below.



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	$-CH(CH_3)_3$bend
	Two bands		
	715 - 725	w	$-(CH_2)n$ 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
	1100	m	C-C-C bending
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

$10^{1}/_{2}$ marks

5b) Deduce from the identified functional groups what class of organic compound it is whose IR spectrum appear in 5a above.$4^{1}/_{2}$ marks