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
JULY 2017 EXAMINATION

COURSE CODE: CHM 391

COURSE TITLE: PRACTICAL CHEMISTRY V – INORGANIC AND

                         ANALYTICAL

COURSE UNIT: 2 Units

TIME: 2 HOURS

INSTRUCTION: Question one is compulsory. Answer question one and

                 any other three questions.

1ai) How would you determine the wavelength of maximum absorption of an organic molecule whose wavelength of maximum absorption is unknown?   (6 marks)

1aii) List the kind of compounds that are capable of absorbing UV-Visible radiation.   (3 marks)

1aiii) Among the compounds listed in 1aii above, which of them strongly absorb UV-Visible radiation or absorb UV-Visible radiation the most.   (1 mark)

1bi) Below is a table of values obtained for the determination of total alkalinity in a water sample, use this table to calculate the total alkalinity of a 100 ml water sample titrated with 0.02 M H_2SO_4.

NO of titration	Volume of sample (mL)	Initial burette reading	Final burette reading	Volume of Sulphuric (mL)
1	100	0.00	8.50	8.50
2	100	0.00	8.30	8.30

| 3 | 100 | 0.00 | 8.30 | 8.30 |

(5 marks)

1bii) Mention the indicators used to detect the presence of the following sources of alkalinity in water samples.   (2 marks)

1biii) Give two significance and application of alkalinity.   (2 marks)

1ci) Outline the experimental procedure of how to determine the functional groups present in an organic sample.   (5 marks)

1cii) What kind of molecules absorb infrared radiation.   (1 mark)

2a) In an experiment to determine the concentration of lead in soil collected from the side of a road using atomic absorption spectrophotometer, standard lead solutions were prepared and the absorbance of each solution measured. The data below was obtained.

Standard solutions	Concentration (ppm)	Absorbance
Blank	0.00	0.00
Standard 1	1.00	0.17
Standard 2	2.00	0.34
Standard 3	3.00	0.48
Standard 4	4.00	0.65
Standard 5	5.00	0.83

If the absorbance of the road side soil sample was 0.58, determine the concentration of lead in the soil sample from a calibration curve prepared by you. $(13^1/_2$ marks)

2b)Mention   one   use   of   atomic   absorption   spectroscopy   (AAS). $(1^1/_2$ marks

3a) In an analysis to determine the chloride present in a given sample weighing 1.52g by precipitation gravimetric method, aqueous solution of the sample was acidified with dilute acid

and a slight excess of silver nitrate solution was added, whereupon the chloride present in the sample was precipited as silver chloride. If the weight of the silver chloride precipitate obtained is 0.126 g, calculate the percentage of chloride in the sample. Gravimetric factor = Cl/Agcl =0.24737   (9 marks)

3b) What is digestion of a precipitate and why is it necessary?   (6 marks)

4a) Identify the functional groups present in the infrared spectrum given below using the table of characteristic infrared absorption bands of organic functional groups provided below.
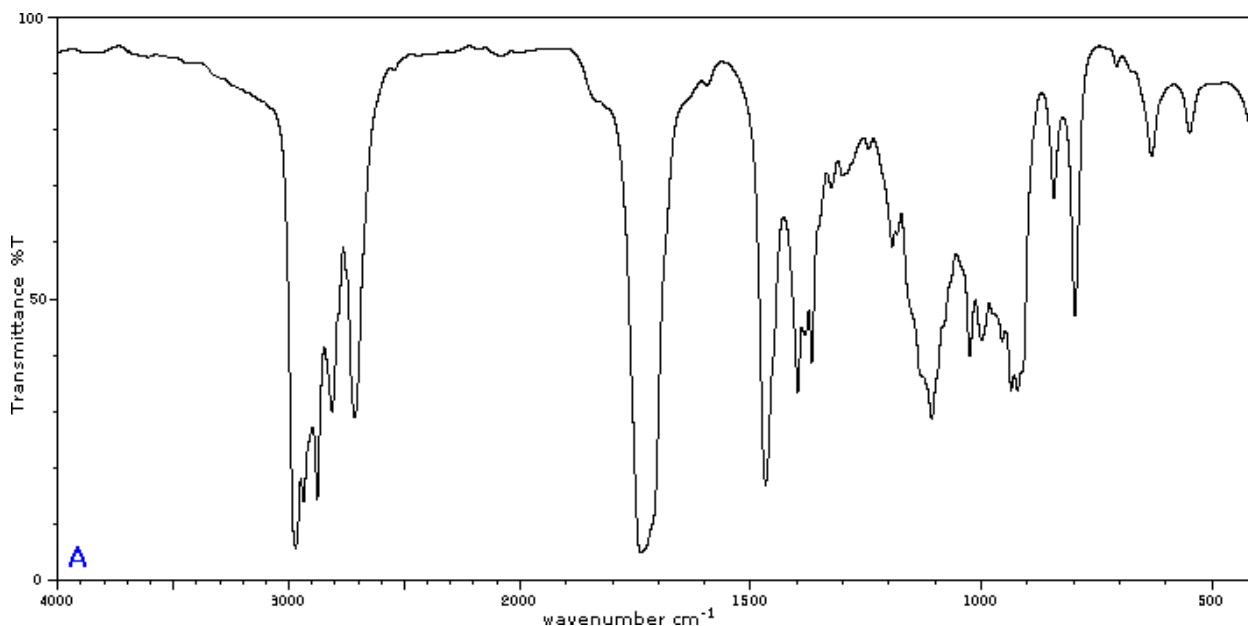
CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS

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	m	=C-O-C sym and asym
	1200-1275		stretch
	(Two bands)		
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

(12 marks)

4b) In what way is potentiometric titration different from classical titration.   (3 marks)

5a) The concentration of an organic compound is to be determined using UV-visible spectrophotometer, if the wavelength of maximum absorption (λ max) of this organic compound is unknown, use the information provided below to obtain the wavelength of maximum (λ max) at which the determination will be carried out.

Absorbance(s) of the organic compound	Wavelengths of absorption of the organic compound (nm)
0.100	360
0.110	380

0.120	400
0.125	420
0.130	440
0.160	460
0.165	480
0.400	500
0.60	520
1.00	540
1.10	560
0.80	580
0.40	600
0.10	620
0.11	640
0.12	660

(12 marks)

5b) State the advantages of potentiometric titration over classical titration (classical visual indicator method). (3 marks)