NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
SEPTEMBER/OCTOBER 2015 EXAMINATION

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: CHM 391

COURSE TITLE: PRACTICAL CHEMISTRY V – INORGANIC AND ANALYTICAL

TIME: 2 HOURS
INSTRUCTION: ANSWER ANY FOUR QUESTIONS

QUESTION ONE

(a) The concentration of an organic compound is to be determined from its calibration curve by UV-visible spectroscopy, if the wavelength of maximum absorption (λ max) of this compound is unknown, determine the wavelength of maximum (λ max) at which the calibration curve can be prepared using the information provided below.

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
0.16	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

10marks

(b) Describe briefly the principle of UV-visible spectroscopy

$7^1/_2$ marks.

QUESTION TWO

(a) Below is an infrared spectrum of an unknown organic compound. Using the table of the characteristic infrared absorption bands of organic functional groups provided below, identify the functional groups present in this organic compounds.
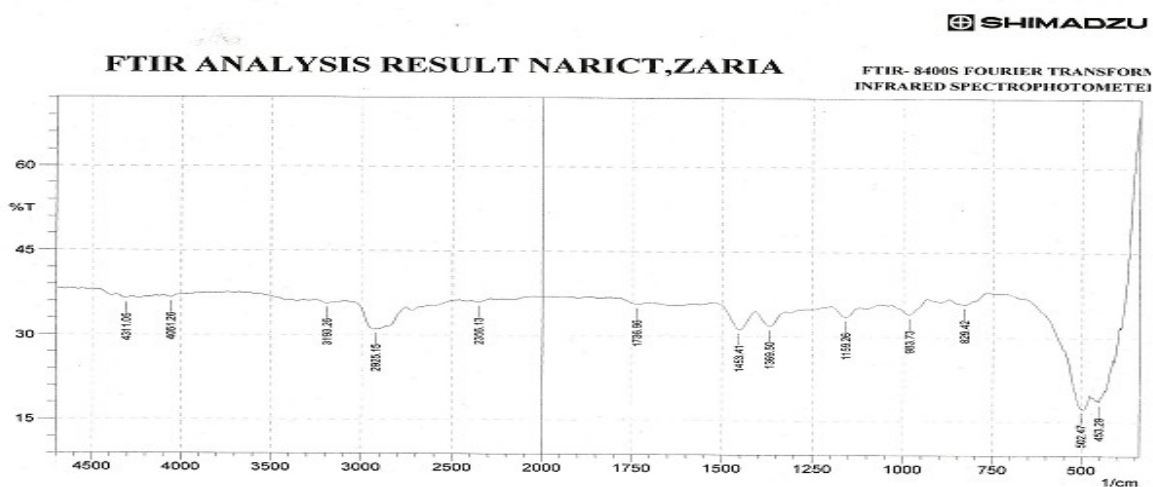

Table : CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS

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 Two bands	m	$-CH(CH_3)_3$ bend
	715 - 725	w	$-(CH_2)n$ bend
Alkenes	3020-3140	w-m	=C-H Stretch
	1640-1670	vw-m	C=C Stretch
	910+990 Two bands	m+s	=C-H bend
	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

9 marks

(b) Explain briefly the principle of infrared Spectroscopy

$8^1/_2$ marks

QUESTION THREE

(a) A laboratory analysis was conducted to determine the amount of aspirin (2-acetylbenzoic acid) in a commercial aspirin product using UV-Visible Spectroscopic method. The commercial aspirin was complexed with sodium hydroxide and iron (iii) Solution to form the salicylate dianion (the intensity of the colour of the complex is directly related to the concentration of aspirin present) and the absorbance of this complex determined. Five series of solutions with different aspirin concentrations was prepared and labeled A-E and complexed. The absorbance of each solution was measured. Using the information below

(i) Construct a calibration curve
(ii) Use the calibration curve to determine the amount of aspirin in the commercial aspirin product

Concentrations of standard solution (mg/ml)	Absorbances of standard solution	Standard solutions
0.05	0.2	A
0.10	0.4	B
0.15	0.6	C
0.20	0.8	D
0.25	1.0	E

The absorbance of the commercial aspirin product is 0.5

$17^1/_2$ marks

QUESTION FOUR

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(a) Write briefly on the principle of Atomic Absorption Spectroscopy

8 marks

(b) The concentration of magnesium in tap water is to be determined by employing Atomic Absorption Spectroscopy (AAS) to measure the absorbance of magnesium in tap water. A set of standard solutions of magnesium was prepared and their absorbance obtained. Prepare a

calibration curve of the magnesium standard solutions and determine from the calibration curve the concentration of magnesium in the tap water. The absorbance of the magnesium in the tap water read 0. 2

Concentration of magnesium standard solutions (PPM)	Absorbance of magnesium standard solutions
2.50	0.2
4.500	0.3
6.500	0.5
8.500	0.7
10.500	0.9

$9^1/_2$ marks

QUESTION FIVE

(a) 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

(b) What is digestion of a precipitate and why is it necessary

$8^1/_2$ marks

QUESTION SIX

(a) Use a schematic diagram to show the procedure for the separation and identification of a metal cation in a given sample by qualitative inorganic analysis of cation method.

$10^1/_2$ marks

(b)   Differentiate between qualitative analytical groups and groups of the periodic table.7 marks