National Open University Of Nigeria
Plot 91 Cadastral Zone, Nnamdi Azikiwe Express Way, Jabi - Abuja.

Faculty of Science
September/October 2016 Examination

Course Code; Chm 391
Course Title: Practical Chemistry V – Inorganic And Analytical
Time: 2 Hours
Instruction: Answer Any Four Questions

QUESTION ONE

(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 TWO

a.) In what way is potentiometric titration different from classical titration?

(4marks).

b.) Explain briefly the principle of potentiometric titration.

($11^1/_2$ marks).

c.) State one advantage of potentiometric titrations over classical titration (classical visual indicator method).

(2marks).

QUESTION THREE

(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 FOUR

(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.

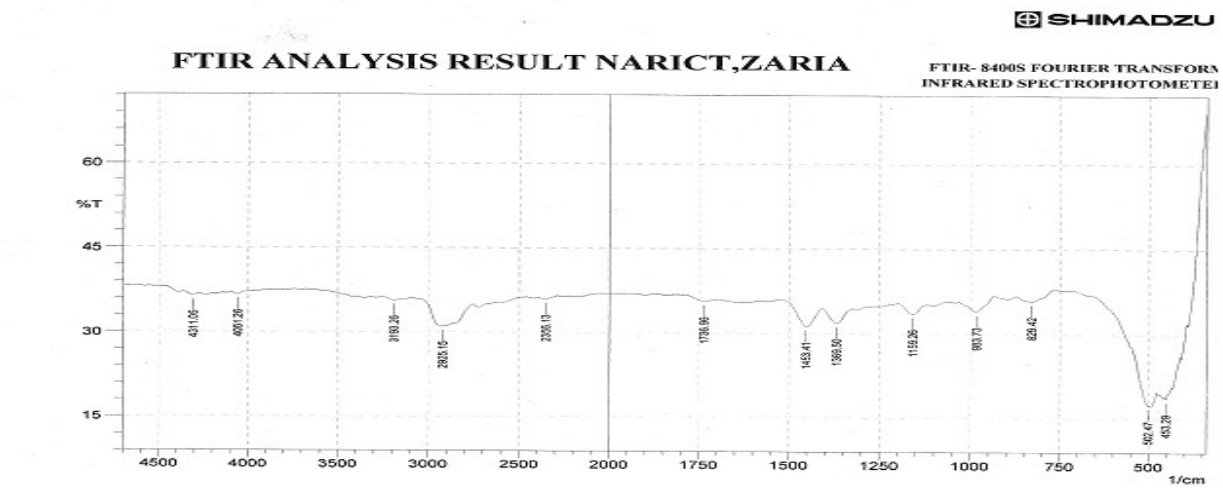

Table : CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS

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	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 1020-1075 and 1200-1275 (Two bands)	s m	C-O-C Stretch =C-O-C sym and asym stretch
Aldehydes	2700-2725 1720-1740 1685-1710	m s s	H-C=O Stretch C=O Stretch C=O Stretch
Carboxylic acids	2500-3500 1710-1715 1680-1710	s bend s, broad s, broad	O-H Stretch C=O Stretch C=O Stretch
Alcohols	3300 – 3400 1125 - 1205	s, broad m - s	O – H stretch 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 FIVE

i. State one significant of acidity in water. ($1^1/_2$marks)

ii) In an experiment to determine the acidity of a water sample, the burette was filled with 0.02M NaOH, 100 ml of the water sample was transferred to a conical flask using pipette and few drops of methyl orange indicator was added to the content in the conical flask. The sample was titrated against the 0.02M NaOH solution until the orange colour became faint. The volume V1 consumed for this titration was noted. To the same solution in the conical flask few drops of phenolphthalein indicator was added and the titration continued until the colour changed to faint pink colour. The total volume V2 consumed for this titration was noted. The experiment was repeated three times to get concordant values.
The values obtained are presented in table 1 and 2. Use these values to calculate:

i. The Mineral Acidity of the water sample

ii. Total Acidity of the water sample

Table 1 for Mineral Acidity

NO of titration	Volume of sample (mL)	Initial burette reading	Final burette reading	Volume of NaOH (mL)
1	100	0.00	0.50	0.50
2	100	0.00	0.40	0.40
3	100	0.00	0.40	0.40

Table 2 for Total Acidity

NO of titration	Volume of sample (mL)	Initial burette reading	Final burette reading	Volume of NaOH (mL)
1	100	0.00	2.20	2.20
2	100	0.00	2.30	2.30
3	100	0.00	2.30	2.30

The molecular weight of $CaCO_3$ = 100g (=100,000mg)

= 16 marks

QUESTION SIX

(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.