

**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**

**APRIL/MAY, 2019 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 three questions.**

**QUESTION ONE**

1ai) Using the data provided below, determine the wavelength of maximum absorption (*λ max)* of the organic compound.

|  |  |
| --- | --- |
| 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 |

6 marks

1aii) If after the determination of the unknown wavelength of maximum absorption (*λ max)* of the organic sample in (1ai) above, the determined wavelength was used to obtain the concentration of the organic compound which was found to be 0.0008 moldm-3 at an absorbance of 1.23, use Beer’s law to calculate molar absorptivity ε for the organic compound, given the cell width (path length *l*) to be 1 cm.31/2 marks

1b) Mention the uses of the following:

1. Gravimetric analysis 1 mk
2. Potentiometric titration 1 mk
3. UV- Visible spectroscopy 1mk
4. Colorimetry 1 mk
5. Infrared spectroscopy 1 mk
6. Atomic absorption spectroscopy 1 mk

1c) How would you set the absorbance of UV-Visible spectrophotometer to zero (0)?

11/2 marks

1d) What is digestion of a precipitate and why is it necessary

3 marks

1fi) Outline the sources of hardness in water. 2 marks

1fii) Of what significance is the determination of hardness in water. 2 marks

1fiii) Mention one method for the determination of hardness in water. 1 mark

**QUESTION TWO**

2a) 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 precipitated 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

2b) Explain briefly the principle of infrared Spectroscopy.  6 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 was 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 |  |

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;

1. Separation of metal cation in a sample**.** 5 marks
2. Identification of metal cation in a sample 5 marks

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

5 marks

**QUESTION FIVE**

5ai) 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.

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**CHARACTERISTIC INFRARED ABSORPTION BANDS OF FUNCTIONAL GROUPS**

|  |  |  |  |
| --- | --- | --- | --- |
| Class of compounds | Absorption cm-1 | Intensity | Assignment |
| Alkanes and Akyls  Alkenes  Alkynes  Ethers  Aldehydes  Carboxylic acids  Alcohols | 2850 – 3000  1450 – 1470  1370 – 1390  1365 +1395  Two bands  715 - 725  3020-3140  1640-1670  910+990  Two bands  885-895  665-730  960-980  790-840  3265-3335  2100-2140  610-700  2190-2260  1085-1150  1020-1075 and  1200-1275  (Two bands)  2700-2725  1720-1740  1685-1710  1100  2500-3500  1710-1715  1680-1710  3300 – 3400  1125 - 1205 | s  s  m  m  w  w-m  vw-m  m+s  s  m-s, broad  s  s  s  m  s  vw-w  s  m  m  s  s  m  s bend  s, broad  s, broad  s, broad  m - s | C – H stretch  C- H bend  CH2, C – H bend  -CH(CH3)3 bend  -(CH2)n bend  =C-H Stretch  C=C Stretch  =C-H bend  =C-H bend  =C-H bend  =C-H bend  =C-H bend  =C-H Stretch  C=C Stretch  =C-H bend  C=C Stretch  C-O-C Stretch  =C-O-C sym and asym stretch  H-C=O Stretch  C=O Stretch  C=O Stretch  C-C-C bending  O-H Stretch  C=O Stretch  C=O Stretch  O – H stretch  C –O stretch |

**Intensity abbreviations**: vw = very weak, w = weak, m = medium, s = strong, vs = very strong

1. marks

5aii) Deduce from the identified functional groups what class of organic compound it is whose IR spectrum appear in 5ai above. 2 marks

5b) Enumerate the significant of acidity in water. 6 marks