



**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**

**FEBRUARY/MARCH 2018 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.**

### **QUESTION ONE**

1a) Explain briefly the principle of infrared Spectroscopy. 6 marks

1b) What is digestion of a precipitate and why is it necessary. 6marks

1c) Calculate the total alkalinity of a 100 ml water sample titrated with 0.03M  $\text{H}_2\text{SO}_4$ , 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

1d) 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

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

2 marks

### QUESTION TWO

2a) The concentration of an organic compound is to be determined from its calibration curve by UV-visible spectroscopy, if the wavelength of maximum absorption ( $\lambda_{\text{max}}$ ) of this compound is unknown, determine the wavelength of maximum ( $\lambda_{\text{max}}$ ) 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                                                    |
| 0.160                                 | 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                                                    |

7<sup>1</sup>/<sub>2</sub>marks

2b) Describe briefly the principle of UV-visible spectroscopy.

7<sup>1</sup>/<sub>2</sub> 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<br>(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.

11marks

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

#### QUESTION FOUR

4a 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.

9 marks

4b) What are the sources of acidity in a water body and why is it necessary to determine acidity of a water sample.

6 marks

#### QUESTION FIVE

5a) 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 0.126g, calculate the percentage of chloride in the sample. Gravimetric factor =  $\text{Cl}/\text{AgCl}$  = 0.24737.

8 marks

5b Mention the sources of hardness, and state the methods of their determination. 7 marks