

**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**

**OCTOBER/NOVEMBER, 2019 SECOND SEMESTER EXAMINATION**

**COURSE CODE: CHM 306**

**COURSE TITLE: INSTRUMENTAL METHODS OF ANALYSIS**

**COURSE UNIT: 2**

**TIME: 2 HOURS**

**INSTRUCTION: Answer question one and any other three questions.**

**QUESTION ONE**

1a) Define the following:

i. Spectroscopy ii. Fluorimetry iii. Polarography iv. Refractometry

**6 marks**

b) State the following spectrophotometry laws

i. Beer’s law ii. Lambert’s law

**2 marks**

c) Distinguish between absorption and emission spectroscopy. **2 marks**

d) Based on the nature of the radiation that is absorbed or emitted, highlight the different types of spectrotroscopy. **21/2 marks**

e) Write on the NMR spectroscopy under the following headings:

i. Basic Principle **(31/2 marks)** ii. Applications **(2 marks)**

f(i) What information can be obtained from measuring the refractive index of a compound using a refractometer? 3 marks

f(ii) A student measured 1.2821 as a refractive index of an organic liquid at 180C. What is the corrected refractive index?  **4marks**

**QUESTION TWO**

2a.) Explain briefly the five different methods of optical analysis. **5 marks**

bi) Define and give mathematical expressions of:

i. Absorbance **2 marks**

ii. Transmittance **2 marks**

bii) Show and state the relationship between absorbance and transmittance. **2 marks**

(c) Identify the two major types of molecular vibrations and list their classes. **4 marks**

**QUESTION THREE**

3ai) what happens when infrared radiation of a characteristic frequency interacts with a molecule? **6 marks.**

3aii) Distinguish between the following:

Finger print region **2 ½ marks**

Group frequencies. **3 ½ marks.**

3b) Write short note on the monochromator and detector of a typical spectrophotometer.

3 marks

**QUESTION FOUR**

4ai) What is meant by ‘x-ray diffraction’? **1 mark**

4aii) Give a brief account of the basic principle of operation of x-ray diffraction.

**8 marks**

4bi) List two (2) applications of x-ray diffraction analysis.

**2 marks**

4bii) What is the effect of x-ray diffraction on the configuration of atoms? **4marks**

**QUESTION FIVE**

5a) Explain the working principle of the following spectroscopy.

1. flame emission spectroscopy (FES) **5 marks**
2. flame atomic absorption spectroscopy (FAAS) **5 marks**

5b) Compare and contrast between electronic, vibrational and rotational spectroscopy **5 marks**