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
SECOND SEMESTER EXAMINATION 2021_2 45678

COURSE CODE: **CHM306**
COURSE TITLE: **INSTRUMENTAL METHODS OF ANALYSIS**
TIME: **2 HOURS**
INSTRUCTION: **Answer question one and any other three questions.**

QUESTION ONE

1ai. What is electromagnetic radiation? Hence define the two parameters that can be used to characterize electromagnetic radiation

(5 marks)

1aii. State five types or components of electromagnetic radiation. (5 marks)

1aiii. Give an equation that relates wavelength, frequency and energy of electromagnetic radiation

(4 marks)

1b. Differentiate between atomic and molecular absorption spectroscopy

(2 marks)

1ci. In Nuclear Magnetic Resonance (NMR) common standard is used in calibration, what is this?

(1.5 marks)

1cii. State the effect of external magnetic field on proton orientation of a given sample.

(3 marks)

1d. Describe fourier transform spectroscopy

(4·5marks)

QUESTION TWO

2ai. What is a detector in spectroscopy and How do they operate? Give example of a detector (3 marks)

2aii. Name the two classes of photoelectric detector

(2 marks)

2aiii. What are the best detectors for near, mid and far infra red radiation

(2 marks)

2aiv. List the four types of detector that are generally used in spectrophotometer (2 marks)

2bi. Highlight three major differences between a colorimeter and spectrophotometer and hence state the advantages of spectrophotometer over colorimeter

(6 marks)

QUESTION THREE

1ci. What are the different types of flame spectroscopy

(2 marks)

1cii. Distinguish between the types of flame spectroscopy.

(5 marks)

1ciii. How useful are the flame spectroscopies

(3 marks)

1d. Compare and contrast the atomic and molecular emission

(5 marks)

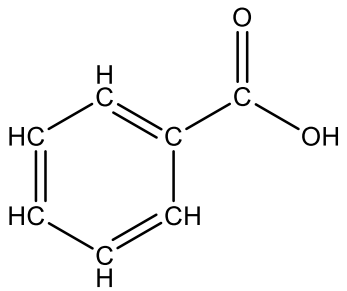
QUESTION FOUR

4ai. State the two types of fundamental vibrations that are possible in organic molecules. Hence state the different sub vibrations that are associated with the two

(7 marks)

4aii. Which vibration is useful for chemical identity and why? (2 marks)

4b. Identify all the functional groups (in the molecule below) that can be detected by Infra red spectrophotometer



(6 marks)

QUESTION FIVE

5ai. Enumerate the steps required for emission of radiation by an atom or molecule (4 marks)

5a(ii) Calculate the energy of an electromagnetic radiation whose wave length is 100 m (Speed of light c = 3×10^{8} m/s, Planck constant, h = 6.6261×10^{-34} $m^2/kg/s$ = 6.6261×10^{-34} Js).

(4 marks)

(5b) Highlight the major features of electronic, vibrational and rotational spectroscopic, stating the source of energy needed for each of them

(6 marks)

(5c) On what two parameters is the unit of measurement of electromagnetic radiation based?

(1 mark)