FACULTY OF APPLIED AND HEALTH SCIENCES DEPARTMENT OF PURE & APPLIED SCIENCES **UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN ANALYTICAL CHEMISTRY **&** DILPLOMA IN SCIENCE LABOROTORY AND TECHNOLOGY.

ACH 2303: Instrumental Methods of Analysis II (paper1)

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2024

TIME: 2 HOURS

DATE: Pick Date Dec 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt **Question one** and any other **TWO questions**.

Do not write on the question paper.

Question ONE

a) Metal complexes with low volatility are often difficult to analyze when performing atomic absorption measurements because the atomization efficiency is reduced to unacceptably low levels. Describe a method for eliminating complexing agents during analysis of non-volatile metal complexes. **(5marks)**

b) State the three components of a molecular energy state **(3 marks)**

c) The Absorption spectra of a molecule is a band and not line. Using molecular energy-level diagram explain this occurrence. **(8 marks)**

d) Differentiate between emission and absorption spectra **(2 marks)**

e) State the four quantum numbers which define the electronic energy levels and atomic orbitals of an atom **(4 marks)**

g) Define the following terms as employed in Instrumental methods of analysis;

i. Ground state **(2 marks)**

ii. Excited state **(2 marks)**

iii. Singlet state **(2 marks)**

iv. Triplet state **(2 marks)**

Question TWO

a) Describe the principle of an atomic absorption spectrophotometer **(3 marks)**

b) Draw a well labeled schematic diagram of a double-beam atomic absorption spectrophotometer **(12 marks)**

Question THREE

a. Calculate the ratio of sodium atoms in the 3p excited state to the number in the ground state 3s at 3050K in oxyacetylene flame (E = 3.371×10^{-19} J, Boltzmann constant 1.38×10^{-23} J/K) **(7 marks).**

b. Is atomic emission analysis of sodium sensitive to fluctuations in the flame temperature? **Explain.** **(3marks)**

c. Is atomic absorbance analysis of sodium sensitive to fluctuations in the flame temperature? **Explain.** **(3 marks)**

d. Explain why flame photometry is also called atomic flame emission spectrometry **(AES)?** **(2marks)**

Question FOUR

b) Differentiate between fundamentals and overtones as used in IR spectroscopy **(3 marks)**

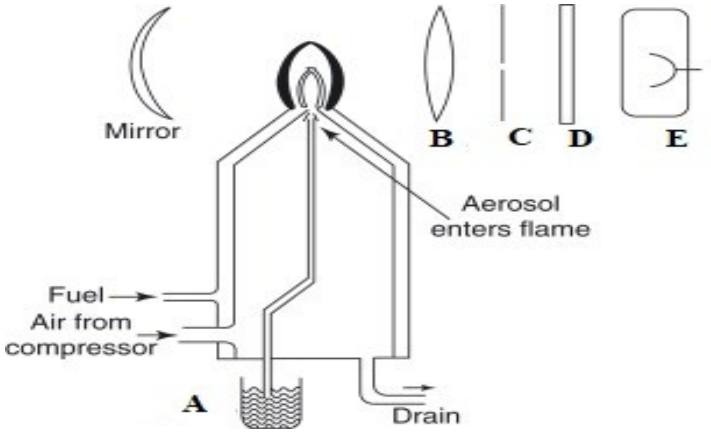
a) State the two modes of molecular vibrations **(2marks)**

c) Calculate the wavenumbers and wavelength of the fundamental absorption peak due to the stretching of the carbonyl group (**C=O**) **(10 marks)**

Force constant = 5.0 x 10^6 dynes/cm Avogadro's constant = 6.023 x 10^{23} C = 12, O = 16

Question FIVE

a) Name the parts labeled **A, B, C, D & E** and state their functions **(10 marks)**



b) Explain why pressed pellets technique of preparing samples in IR spectroscopy, potassium bromide (KBr) is preferred to sodium chloride (NaCl) as solvent. **(3marks)**

c) State two advantages of using AAS as a chemical analytical tool **(2marks)**