

**NATIONAL OPEN UNVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE & APPLIED SCIENCES**

**2018\_2 EXAMINATION QUESTIONS**

**COURSE CODE: CHM 309**

**COURSE TITLE: APPLIED SPECTROSCOPY**

**COURSE UNIT: 2**

**INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER 3 QUESTIONS**

**TIME ALLOWED 2 HOURS.**

Q1 a) Write short notes on the following:

i**.** Absorption spectroscopy **(1 mark)** ii. UV/Vis spectroscopy **(2 marks)**

iii. IR spectroscopy **(3 marks)**

b) Define the following:

i. Auxochome **(1 mark)** ii. Bathochromic shift **(1 mark)**

c)Briefly explain the following rules as they affect Mass spectroscopy.

i. Nitrogen rule **(2 marks)** ii. Unsaturation sites rule **(2 marks)**

(d) How does each of the following affects the absorption of radiation in the UV/Vis region?

i. Solvent Effects **(2 mark)** ii. Substituent Effects **(3 marks)**

e) Give a brief account of fragmentation patterns in alkanes. **(3 marks)**

f) Enumerate the five basic components of a typical NMR spectrometer and outline one function of each.  **(5 marks)**

Q2. (a) Explain the basic principle of UV/Vis spectroscopy. **(8 marks)**

(b) Draw a schematic diagram of a UV/Vis spectrophometer and explain its basic components. (**7 marks)**

Q3. (a) Vividly describe how Beer-Lambert’s law is used in the determination of organic

compounds or inorganic complexes by direct absorptiometry. **(5marks)**

(b) Two organic compounds, A (λmax = 255) and B (λmax = 330), has the following information:

*Pure solution of A, ε(255) = 4.60; ε(330) = 0.46, Pure solution of B, ε(255) = 3.88; ε(330) = 30.0*

*Mixture of A and B in a 0.01 m cell, A(255) = 0.274 and A(330) = 0.111*

Calculate their respective concentrations **(5 marks)**

(c) i. Briefly explain how UV/Vis spectroscopy assist in Pharmaceutical Quantitative

Analysis. **(1½ marks)**

ii. Tablet powder containing ca. 0.25 g of furosemide (frusemide) is shaken with 300 cm3 of 0.1 M NaOH to extract the acidic furosemide (frusemide). The extract is then made up to 500 cm3 with 0.1 M NaOH. A portion of the extract is filtered and 5 cm3 of the filtrate is made up to 250 cm3 with 0.1M NaOH. The absorbance of the diluted extract is measured at 271 nm. The A (1%, 1cm) value at 271 nm is 580 in basic solution. **(2 ½ marks)**

[**Stated content per tablet; 40 mg of furosemide (frusemide), Weight of 20 tablets = 1.656 g, Weight of tablet powder taken for assay = 0.5195 g, Absorbance reading = 0.596**]

From the data, calculate the % of the stated content in the sample of furosemide tablets. **(1mark)**

Q4. (a) Describe how the following could be achieved:

i. Identification of Chromophores in Qualitative Analysis **(3 marks)**

ii. Determination of The partition coefficient of a drug. **(2 marks)**

(b) What is the principle of IR spectroscopy? **(5 marks**

(c) Explain the following in relation to IR spectroscopy:

i. Intensity of Absorption **(2.5 marks)** ii. Energy Level of Absorption  **(2.5 marks)**

Q5. Write short notes on the following, in relation to IR spectroscopy:

(a) Identification of Polymorphs **(5 marks)**

(b) Structural elucidation **(4marks)**

(c) Fingerprint technique in identifying an unknown compound. **(6 marks)**