



Department of Chemistry
Federal University of Technology, Minna
2021/2022 First Semester Examination

Course: Advanced Analytical Chemistry

Course Code: CHM 516

Class: 500L Time: 2 Hours

Instruction: Answer any three questions

Q1a) Why is atomic emission more sensitive to flame instability than atomic absorption **(2 marks)**

b) With specific reference to the analysis of an aqueous MgCl₂ solution, briefly describe

the processes that are likely to occur in a laminar-flow burner **(10 marks)**

ci) Suggest an explanation for the observation that in a hydrogen-oxygen flame, the atomic absorption signal for iron decrease in the presence of large concentrations of sulphate **(5 marks)**

(ii) List three possible methods for overcoming the potential interference of sulphite in a quantitative determination of iron. **(3 marks)**

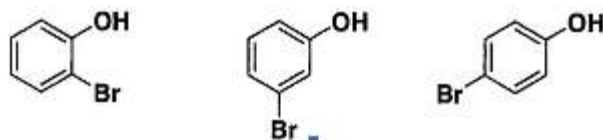
Q2a) Define the following terms: i) virtual state, ii) stroke and iii) anti –Stroke **(4½marks)**

bi) What are the requirements for a vibrational mode to be Raman active? **(2 marks)**

ii) Assume that a molecule has three Raman active vibrational modes at 500, 1000 and 1500 cm⁻¹ using the laser frequency of Kr at 568,20 nm. Plot the full Raman spectrum (including both the stokes and anti-stokes regions of the spectrum) **(6 marks)**

c) Enumerate five advantages of Raman spectroscopy despite providing unique information about a sample. **(7½marks)**

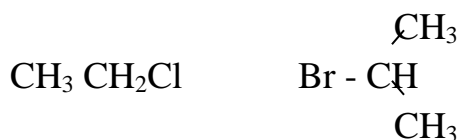
Q3a) Using only ¹H NMR spectroscopy, distinguish between the following isomers? **(3 marks)**



bi) By means of a formula only, express how Quantum description of NMR shows that nuclear angular momentum is quantized (**5 marks**)

bii) What are the significance of spin quantum number (I) in structural elucidation using NMR (**5 marks**)

c)) Express the multiplet splitting patterns expected for common fragments of the following compound in NMR: (**7 marks**)



Q4a) Draw a block diagram illustrating the concept of Mass spectrometry (MS) (**6 marks**)

b) Why do we need vacuum in MS (**3 marks**)

c) An unknown substance shows a molecular ion peak at $m/z = 170$ with a relative intensity of 100. The $M + 1$ peak has an intensity of 13.2, and the $M + 2$ peak has an intensity of 1.00. What is the molecular formula of the compound? (**11 marks**)