KENYATTA UNIVERSITY

SUPPLEMENTARY/SPECIAL EXAMINATION 2021/2022

EXAMINATION FOR THE DEGREE OF BACHELOR OF PHARMACY

PPC 420: PHARMACEUTICAL CHEMISTRY IV

AUGUST, 2022 TIME: 3HOURS

INSTRUCTIONS: **1. The paper consists of three sections; A, B and C**

2. Answer all questions

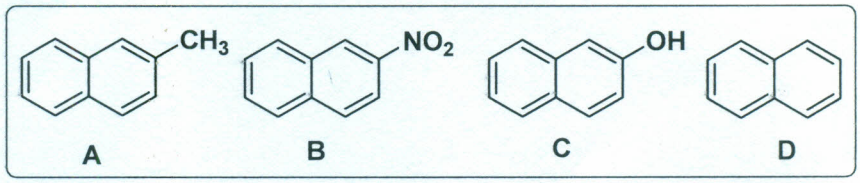
3. Answer sections A, B and C in separate booklets

SECTION A: SPECTROSCOPY I

1. Calculate the percentage of incident radiation absorbed by an analyte with an absorbance of 0.700. (3 marks)

2. Explain five instrumental causes of deviation from Beer's law. (5 marks)

3. With explanation, arrange the following compounds in the order of decreasing fluorescent intensity. (4 marks)



4. Several standard solutions of a compound were prepared and the absorbance at 534 nm of each solution was measured in a 5.00 cm cell. The absorbance of each solution was plotted as a function of its concentration. The plot was linear with a slope of 973 L/mole and went through the origin. The absorbance of the sample solution was 0.493 in a 1.00 cm cell at 534 nm. Calculate the concentration of the absorbing compound in the sample solution.

(5 marks)

5. During polarimetric assay using sodium D line at 25 °C in a 1 dm cell, a solution of 0.128 M phenylephrine hydrochloride (molecular weight = 203.66) in 0.1 M HCl gave an angle of

rotation, $\alpha = -0.98°$. Calculate the specific optical rotation $[\alpha]$ for phenylephrine hydrochloride and express it in the conventional form. (6 marks)

6. Regarding infrared spectroscopy:
   a) Convert 6000 nm and 12500nm wavelengths to wavenumbers. (2 marks)
   b) Explain five methodsthrough which a non-polymorphic pharmaceutical substance may be prepared to obtain an IR spectrum from a Fourier Transform Infrared Spectrophotometer (FTIR). (5 marks)

7. Discuss five types of interferences encountered in atomic spectrophotometry. (10 marks)

SECTION B: SPECTROSCOPY II

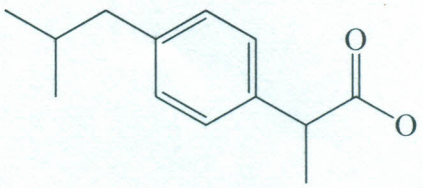
1. Define the following terms as used in NMR spectroscopy (3 marks)
   a) Chemical shift
   b) Coupling constant
   c) Chemically equivalent protons

2. Describe how presence of the following elements can be confirmed in a mass spectrum: (3 marks)
   a) Nitrogen
   b) Bromine
   c) Chlorine

3. State the key information provided by a ^{1}H NMR spectrum. (4 marks)

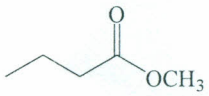
4. Explain the working principle of a tandem mass spectrometer (4 marks)

5.
   a) Using the structure of ibuprofen below, identify the different signals observed in the ^{1}H-NMR spectra. Illustrate your answer on the structure. (7 marks)



ibuprofen

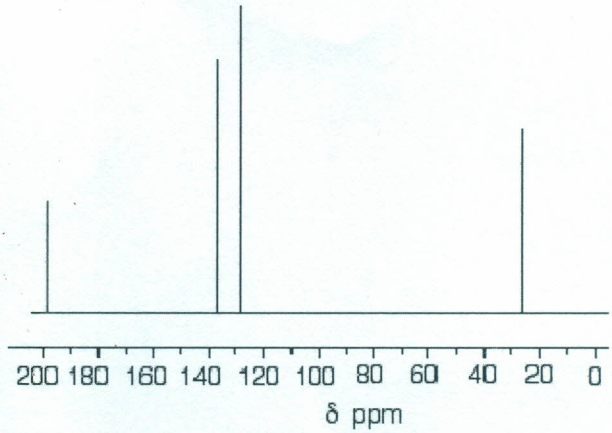
b) Identify the most shielded and the least shielded set of protons on the methylbutanoate structure (3 marks)



methylbutanoate

6. Outline the procedure of how you would identify a drug using a mass spectrometer. (8 marks)

7. Below is the ^{13}C-NMR spectrum of 3-buten-2-one. With reason, assign each signal to the appropriate carbon atom. (8 marks)



SECTION C: ELECTROCHEMICAL METHODS

1. Define the following terms: (4 marks)
   a) Potentiometry.
   b) Diffusion current.
   c) Junction potential.
   d) Polarography.

2. Explain why the useful potential range of a dropping mercury electrode is about 0 V to -2 V. (5 marks)

3. Describe how residual current is generated during polarographic analysis. (6 marks)

4. Identical Ag/AgCl electrodes, connected via a digital voltmeter, were placed in separate solutions which were connected by an appropriate salt bridge. The first solution contained 1.0×10^{-3} M KCl and the second contained 100.0 mL of a sample solution. After addition of 4.75 mL of 0.01

M KCl to the sample solution, the emf between the electrodes was zero. Calculate the concentration of KCl in the sample solution. (7 marks)

5. Discuss four amperometric titration curves. (8 marks)

6. Regarding glass membrane ion-selective electrode:

   a) Draw a well-labelled diagram depicting its components. (5 marks)

   b) Outline how you would carry out quantitative analysis by one-point standard addition method. (5 marks)