Index No:.....

UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME

FOURTH BPHARM PART I EXAMINATION – JUNE 2015

PH 4123: PHARMACEUTICAL ANALYSIS (SEQ)

TIME: TWO HOUR

INSTRUCTIONS

- Answer ***all*** questions.
- Do not use any correction fluid.
- *Answer questions in the space provided for each question.*
- *Marks will be penalized for illegible hand writing.*

01. Answer **all** parts

1.1. Write down the various types of possible electronic transitions of an organic molecule.

(15 marks)

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1.2. State the Beer-Lambert Law.

(05 marks)

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1.3. A 3.25 x 10^{-5} *mol* dm^{-3} unknown solution has a transmittance of 18.4% when measured in a 1.05 cm cell at a wavelength of 525 nm. Calculate the absorbance of this solution.

(10 marks)

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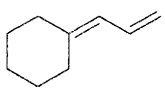
1.4. Using Woodward-Fieser rules, calculate the λ_{max} for the following compounds.

1.4.1. 

(15marks)

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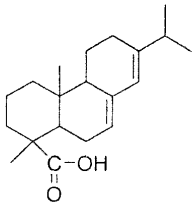
1.4.2. 

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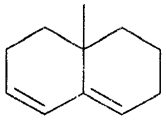
1.4.3. 

(15marks)

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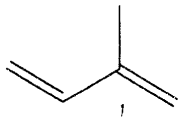
1.4.4. 

(15marks)

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1.5. A chemist placed 1,3,5-hexatriene and 1,3,5,7- octatetraene in separate flasks without labeling them. How the two compounds could be differentiated by UV spectroscopy? ***(10 marks)***

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02. Answer **all** parts.

2.1. Briefly describe the term "the fundamental modes of vibration of a molecule".
(04 marks)

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2.2. Calculate the number of fundamental modes of vibration of H_2S and HCN molecules.
(20 marks)

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2.3. How would you distinguish between the two compounds in each of the following pairs by infrared spectroscopy?

2.3.1. $H_3C\text{-}(CH_2)_2\text{-}N(CH_3)_2$ and $H_3C\text{-}(CH_2)_2\text{-}NH_2$ ***(12 marks)***

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2.3.2. $H_3C\text{-}(CH_2)_2\text{-}COOH$ and $H_3C\text{-}(CH_2)_2\text{-}COOC_2H_5$ ***(12 marks)***

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2.3.3. $H_3C\text{-}CH_2\text{-}COCH_3$ and $H_3C\text{-}CH_2\text{-}CHO$ ***(12 marks)***

2.4. C==O stretching frequency of $H_3C\text{-}CO\text{-}CH_3$ is 1720 cm^{-1} and that of $H_3C\text{-}CO\text{-}NH_2$ is 1680 cm^{-1}. Briefly explain the difference of the C==O stretching frequencies.
(20 marks)

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2.5. The carbonyl stretching frequency of benzoic acid occurs at 1724 cm^{-1} while that of salicylic acid occurs at 1660 cm^{-1}. Explain.

(***20 marks***)

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03. Answer **all** parts

3.1. Define the term "spin quantum number (I)".

(***12 marks***)

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3.2. Spin quantum number (I) for different nuclei can be varied from zero to higher values. Write down the (I) values for the following nuclei. (***12 marks***)

3.2.1. ^{1}H

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3.2.2. ^{2}H

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3.2.3. ^{12}C

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3.2.4. ^{13}C

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3.3. Calculate the number of orientations possible for the magnetic moment of proton nucleus when placed in a strong magnetic field. (***10 marks***)

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3.4. Draw the schematic diagram of possible orientations of the magnetic moment of a proton in an external magnetic field. (***15 marks***)

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3.5. Define the term "chemical shift". (***10 marks***)

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3.6. At 60 MHz, the shift of the proton in CH_3Br is 162 Hz from TMS. While at 100 MHz the shift is 270 Hz. Calculate the shift of the frequency of the proton in CH_3Br from TMS at 600 MHz. (***10 marks***)

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3.7. A molecule with the molecular formula C_3H_6O gives only one peak in its proton NMR spectrum. Deduce the structure of this compound. (***11 marks***)

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3.8. Predict the number of peaks and the multiplicity of each peak in the proton NMR spectrum of the following molecules.

3.8.1. CH_3-CH_2Cl ***(10 marks)***

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3.8.2. CH_3-O-CH_2CN ***(10 marks)***

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04. Answer **all** parts.

4.1 The standard potential of the cell Ag|AgI(s)|AgI(aq)|Ag is +0.9509 V at 25 ^{0}C. Use this cell to answer following questions.

4.1.1 Identify the redox couple in each half cell.

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(***05 marks***)

4.1.2 Write down half-cell reactions and the overall cell reaction.

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(***10 marks***)

4.1.3 Determine the solubility of AgI and the solubility product of AgI

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(***10 marks***)

4.2 Conductometry can be used to detect the end point of an acid-base titration.

4.2.1 Draw the conductance vs volume of NH_4OH for titration of CH_3COOH by NH_4OH and explain the reasons for shape of the graph and how the neutralization point is located.

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(***25 marks***)

4.3 Voltammetry is a widely used reliable electroanalytical method in which polarization of working electrode is always encouraged.

4.3.1 Write short accounts on following terms.

4.3.1.1 Polarization

4.3.1.2 Overpotential

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(*15 marks*)

4.3.2 Draw a rough sketch of current vs voltage plots for polarography and hydrodynamic voltammetry. Explain their shapes giving reasons.

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(*10 marks*)

4.4 Turbidimetry and Nephilometry are two techniques based on scattering of light.

4.4.1 State the major difference between Turbidimetry and Nephilometry.

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(10 marks)

4.4.2 In a turbidimetry experiment percentage transmittance obtained for a colloidal suspension of 1.0 ppm is 80 %. Determine percentage transmittance of 2.5 ppm solution of the same substance.

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(15 marks)

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