Library

FACULTY OF ALLIED HEALTH SCIENCES, UNIVERSITY OF RUHUNA

Department of Medical Laboratory Science

Year End Examination, Year 1 – 2017/2018 Batch (11th Batch)

MLS 1101- Basic Sciences (Chemistry) – SEQ

Date: 02nd September 2020 Time: 9.00 a.m. - 10.00 a.m. Duration: 01 hour

Answer all questions **Index Number: .....**

122

- *Use of calculators is allowed.*
- *Answer **all** questions on this paper itself.*
- *Write your answer in the space provided for each question. Please note that the space provided is sufficient for the answer and that extensive answers are not expected.*

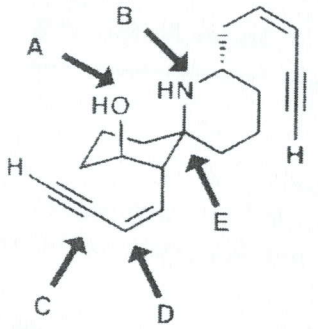
Index Number .....

For Examiner's Use Only

Question No	Marks
1	
2	
3	
4	
5	
Total	
Percentage	

01. Answer **all** parts

Following molecule is a toxin produced by poison dart frog.



1.1 State hybridization of the marked atoms (**A. B. C. D. E**) of the above molecule.

A: .....**B**.....**C:** .....**D** : .....**E**: .....

[10 marks]

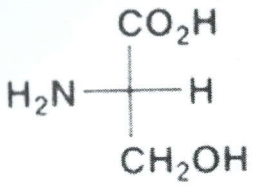
1.2 Identify the stereocenters of the above molecule and mark them on the structure using an asterisk (*).

[10 marks]

1.3 Draw the molecular orbital energy-level diagram of C-C triple bond.

[30 marks]

1.4 Draw the enantiomer of the following molecule and assign the (R) or (S) configuration for both isomers.



(121)

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[20 marks]

1.5 State a physical property, which can be used to identify them from each other.

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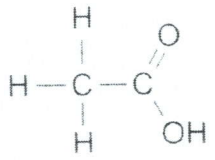
[05 marks]

1.6 Draw Newman projections for all **eclipsed** conformations formed by rotation from 0° to 360° about carbon-carbon single bond of 1.2-dichloroethane and state which conformation has the **highest energy.**

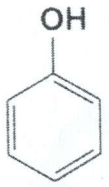
[25 marks]

02. Answer all parts

2.1 State which of the following molecules **A** and **B** has a higher pKa.



A



B

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[10 marks]

2.2 Draw the conjugate bases of the above **A** & **B** and briefly explain the reason for your answer in 2.1.

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[25 marks]

2.3 What type of electronic transitions are responsible for the absorption of UV light in molecules **A** and **B**?

120

A

B

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[10 marks]

2.4 Which of the above compounds would have higher λ_{max}? Explain your answer.

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[10 marks]

2.5 Calculate the concentration of a NADH solution given that the absorbance at 340 nm is 0.4, the molar absorptivity coefficient is 6220 mol^{-1} dm^3 cm^{-1} and the path length is 1 cm.

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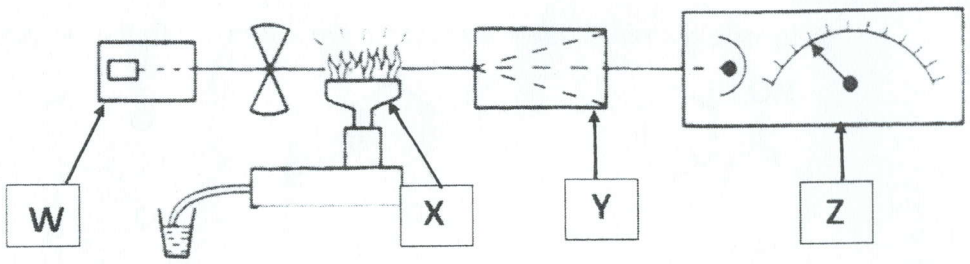
[10 marks]

2.6 A schematic diagram of an analytical instrument is given below:



2.6.1 Identify the instrument.

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[05 marks]

2.6.2 Name parts **W-Z**

W: ..... **X** : .....

Y: ..... **Z**: .....

[15 marks]

2.7 Describe the difference between line spectra and continuous spectra.

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[15 marks]

03. Answer **all** parts.

3.1 4.06 g of impure magnesium oxide was completely dissolved in 100.00 cm^3 of 2.0000 *mol* dm^{-3} hydrochloric acid. Titration of this solution required 19.70 cm^3 of 0.2000 *mol* dm^{-3} sodium hydroxide for neutralization using phenolphthalein indicator

3.1.1 Write equations for the two neutralization reactions.

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[20 marks]

3.1.2 Calculate the moles and mass of magnesium oxide that reacted with the initial hydrochloric acid. [atomic masses: Mg = 24.3, O = 16].

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[30 marks]

3.1.3 What is the % purity of the magnesium oxide?

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[20 marks]

3.1.4 Indicate whether the indicator methyl red (p*K*a = 5.1) is suitable for this titration.

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[10 marks]

3.2 Acid spill can be neutralized with limestone powder. If 2.00 dm^3 of concentrated hydrochloric acid (10.0 $mol\ dm^{-3}$) is spilt onto a laboratory floor.
What minimum mass of limestone powder is needed to neutralize the acid?
[atomic masses: Ca = 40, C = 12, O = 16)

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[20 marks]

04. Answer all parts

4.1 To make a standard calcium ion solution, 0.2500 g of analytical grade calcium carbonate was dissolved in a little dilute hydrochloric acid and made up to 250 cm^3 with distilled water in a volumetric flask.

4.1.1 Calculate the molarity of the calcium ion in this solution.

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[20 marks]

4.2 Approximately 1.0 g of the solid disodium dihydrate salt of EDTA (FW = 372.24 g/mol) was dissolved in 250 cm^3 of deionized water in a volumetric flask. 25.00 cm^3 of this solution was pipetted into a conical flask and ~5 cm^3 of an ammonia/ammonium chloride pH10 buffer was added. After adding a few drops of Eriochrome Black T indicator, the EDTA solution was titrated with the standard calcium ion solution prepared above (from part 4.1). 25.70 cm^3 of the calcium ion solution was required to reach the end point.

4.2.1 Give a simple equation to show the chelation reaction between hydrated calcium ions and the EDTA anion at pH10.

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[10 marks]

4.2.2 What is the molarity of the EDTA solution prepared?

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[20 marks]

4.3 Give the equation that relates, free energy, enthalpy and entropy change in a system under nonstandard conditions.

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[10 marks]

4.4 Which term in the above equation relates to "order" of a system?

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[05 marks]

4.5 Briefly describe how biological systems drive the formation of complex molecules, using an example.

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[15 marks]

4.6 Calculate the osmotic pressure of 0.10 mol L^{-1} sucrose and 0.10 mol L^{-1} NaCl aqueous solutions at 25 °C and comment on your answer. (R= 0.082 L atm mol^{-1} K^{-1})

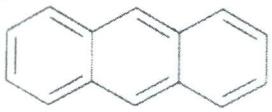
[**20 marks**]

05. Answer all parts.

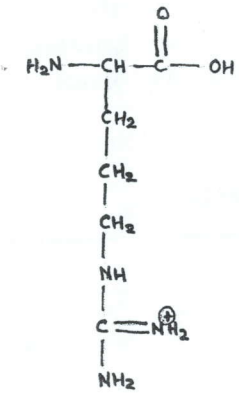
5.1 Classify types of chromatography according to method of separation.

[**10 marks**]

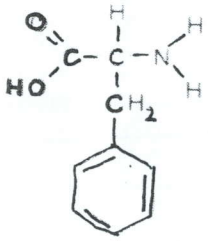
5.2 Predict the order of elution of following molecules in a **reverse phase** liquid chromatography column.



anthracene



arginine



phenylalanine

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[15 marks]

5.3 A chromatographic analysis of a mixture of deoxy-mononucleotides gives a peak for nucleotide A , at a retention time of 250 s with a base line peak width of 70 s, and a peak for nucleotide B , at a retention time of 300 s with a base line peak width of 55 s. Calculate the resolution between A and B.

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[25 marks]

5.4 Radon (222, 86) decays to a stable nuclide by a series of three alpha emissions and two beta emissions. What is the stable nuclide formed? (show your work)

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[20 marks]

5.5 An experiment was designed to determine whether an aquatic plant absorbs iodide ion from water. Iodine -31 with a half-life of 8.04 days was added as a tracer in the form of iodide, to a tank containing the plants. The initial activity of 1.00 μL sample of water was 184 counts per minute. After 30 days the level of activity in 1.00 μL sample of water was 9.5 counts per minute. Show that with a suitable calculation, whether the plants absorb iodide from water.

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[30 marks]