

UNIVERSITY OF RUHUNA  
FACULTY OF ALLIED HEALTH SCIENCES

BACHELOR OF SCIENCE (MEDICAL LABORATORY SCIENCE) DEGREE-  
YEAR I- EXAMINATIONS

02<sup>nd</sup> July 2018

9.00 – 10.00 am

SUBJECT: Chemistry (MLS 1101)

TIME: One (01) hour

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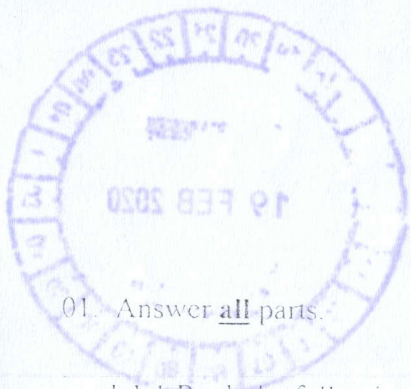
- Use of calculators is allowed.
- Answer all questions on this paper itself.
- Write your answer in the space provided for each question. Please note that the space provided is sufficient for the answer and that extensive answers are not expected.

Index Number .....

For Examiner's Use Only

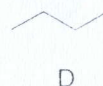
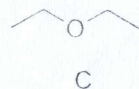
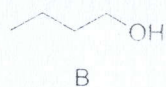
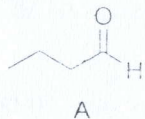
Question No	Marks
1	
2	
3	
4	
5	
Total	
Percentage	

74



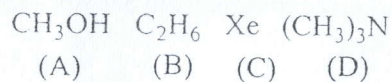
01. Answer all parts.

1.1.1 Rank the following compounds in the order of increasing boiling points.



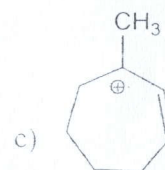
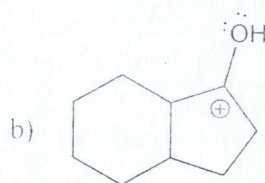
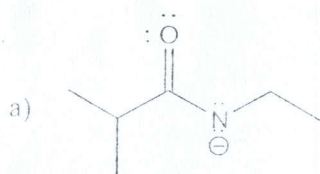
[06 marks]

1.1.2 Which of the following could form *intramolecular* hydrogen bonds?  
Draw the hydrogen-bonded structures.



[08 marks]

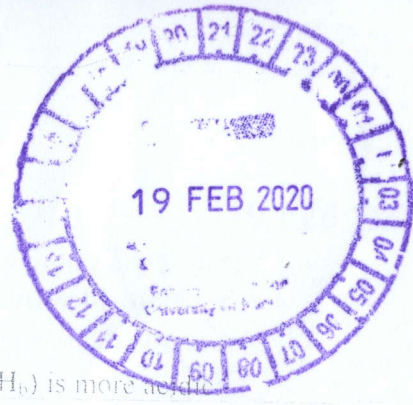
1.1.3 Draw a second resonance form for each of the following structures and indicate which resonance form is more stable in each case.



[06 marks]

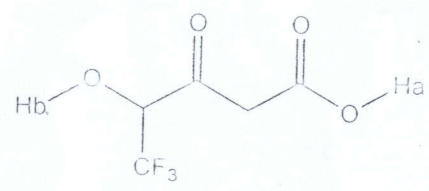
1.2.1 Write the structures of possible isomers of dibromoethene. Which of them will have zero dipole moment ( $\mu$ )?

[06 marks]



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1.2.2 Giving reasons briefly, determine which proton ( $H_a$  or  $H_b$ ) is more acidic

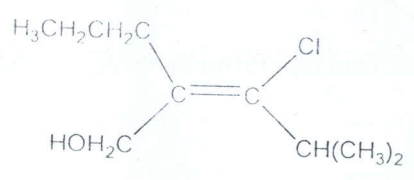


[08 marks]

1.2.3 Draw the staggered conformations of 2, 3-dibromobutane in order of increasing energy.

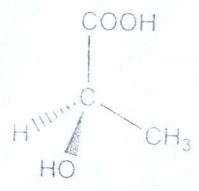
[06 marks]

1.3.1 Assign E/Z designation to the following compound.



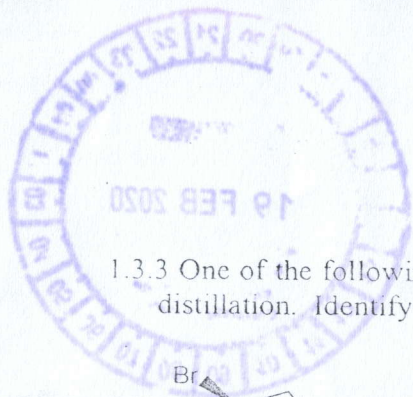
[06 marks]

1.3.2 Draw the Fischer projection of the following compound and name the compound giving R/S designation.

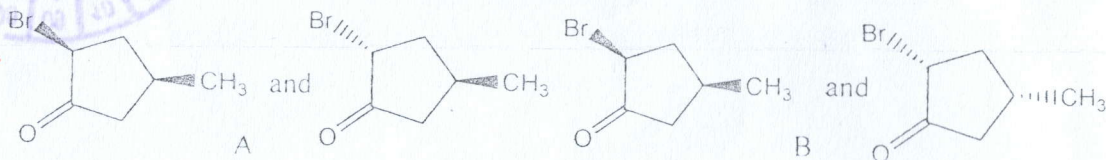


[08 marks]

73



1.3.3 One of the following pairs (A and B) of stereoisomers could be separated by simple distillation. Identify the above mentioned pair giving reasons.



[06 marks]

02. Answer all parts.

2.1 Write balanced nuclear equations for the following transformations and identify the new element/particle formed.

2.1.1 Potassium-38 undergoes positron emission  
(Note: Atomic number of potassium is 19)

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[02 marks]

2.1.2 Lead-211 decays to bismuth-211.

(Note: The atomic numbers of lead and bismuth are 82 and 83; respectively)

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.....

[02 marks]

2.2 State two applications of nuclear chemistry in medicine, give an example for each.

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[04marks]

2.3 Name an instrument that is used to measure radioactivity.

.....  
.....

[02 marks]



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2.4 Briefly describe how ionizing radiation can be harmful to living organisms.

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[03 marks]

2.5 The half-life for the process of conversion of uranium-238 to lead-206 is  $4.58 \times 10^9$  years. A mineral sample which initially contained only uranium-238, has been found to contain 52.0 mg of uranium-238 and 16.0 mg of lead-206 now. Calculate the age of the mineral.

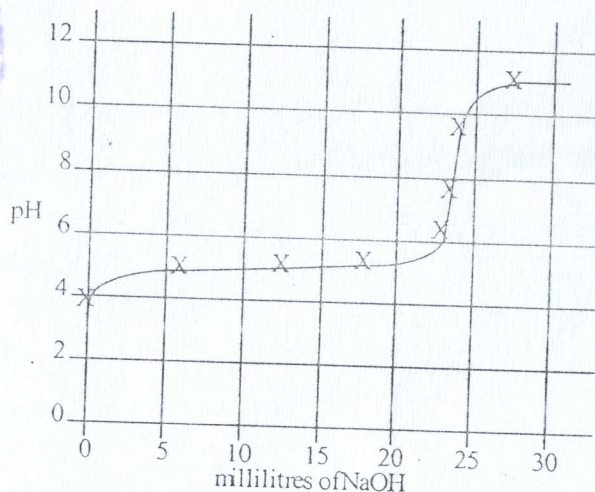
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[07 marks]

03. Answer all parts.

3.1 A 30.00 mL sample of a weak monoprotic acid was titrated with a standardized solution of NaOH. pH was measured after each increment of NaOH was added, and the curve obtained is given below:

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Explain how this curve could be used to determine the:

3.1.1 molarity of the acid.

.....  
.....

[02 marks]

3.1.2 dissociation constant  $K_a$  of the weak monoprotic acid.

.....  
.....

[02 marks]

3.1.3 If you were to repeat this titration using an indicator to find the endpoint, which of the following indicators should you select? Give the reason for your choice. Methyl red ( $K_a = 1 \times 10^{-5}$ ), cresol red ( $K_a = 1 \times 10^{-8}$ ), alizarin yellow ( $K_a = 1 \times 10^{-11}$ )

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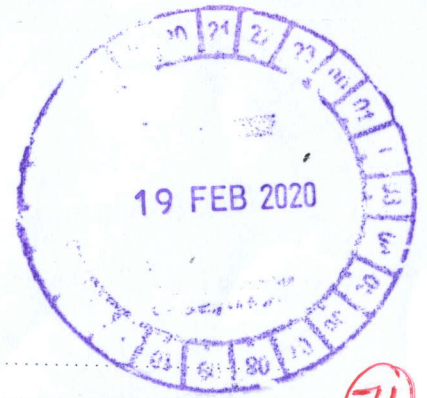
[02 marks]

3.2 The indicator bromothymol blue ( $pK_a = 7.1$ ) has a form,  $HIn(aq)$ , that is yellow and an  $In^- (aq)$  form that is blue.

3.2.1 Write an equation to show how bromothymol blue acts as an indicator.

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[02 marks]



3.2.2 State and explain the colour of bromophenol blue

3.2.2.1 on the addition of a strong acid.

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[01 marks]

3.2.2.2 at the equivalence point of a titration between NaOH and HCl.

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[01 marks]

3.3 If  $25.00 \text{ cm}^3$  of  $0.0100 \text{ mol dm}^{-3}$   $\text{MnSO}_4$  solution buffered at a pH of 7.00 is titrated with  $0.0200 \text{ mol dm}^{-3}$  EDTA solution,

3.3.1 Write a balanced chemical equation for the titration reaction,

.....  
.....

[03 marks]

3.3.2 Calculate pMn at the beginning of the titration

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.....

[04 marks]

3.3.3 Calculate equivalence volume ( $V_e$ )

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[03 marks]

3.4 All three compounds, benzene, naphthalene and anthracene look very similar in their UV spectra.

3.4.1 What common absorption would be expected?

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[03 marks]

3.4.2 What would be the order of increasing their  $\lambda_{\text{max}}$  values?



[03 marks]

3.5 The absorbance of an iron thiocyanate solution containing 0.0050 mg Fe/mL was reported as 0.4900 at 540 nm. Calculate the extinction coefficient, including units, of iron thiocyanate on the assumption that a 1.00 cm cuvette was used.

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[04 marks]

3.6 What are the differences in instrument design in Atomic Absorption Spectroscopy and Atomic Emission Spectroscopy and how are the observed signals generated?

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[10 marks]

04. Answer all parts

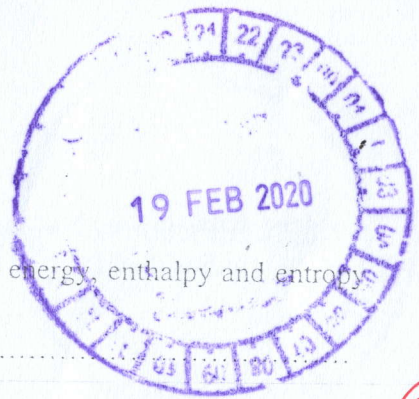
4.1 The terms "endergonic and exergonic" are used for energy changes in biological reactions while terms "endothermic and exothermic" are used in chemical reactions.

4.1.1 Distinguish the above terms used in biological reactions and chemical reactions.

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[10 marks]





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4.1.2 Write down the general expression that relates the free energy, enthalpy and entropy changes in biological reactions?

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[08 marks]

4.1.3 What is the internal energy change in an isothermal expansion of an ideal gas?

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[07 marks]

4.2 Four moles of an ideal gas in an initial state of 300 K and 2 dm<sup>3</sup> volume were isothermally expanded to a final volume of 20 dm<sup>3</sup>.

4.2.1 Calculate the work done by the system using the equation  $w = -nRT \ln \frac{V_f}{V_i}$

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[08 marks]

4.2.2 What is the heat change in the system? (Hint: use the first law of thermodynamics)

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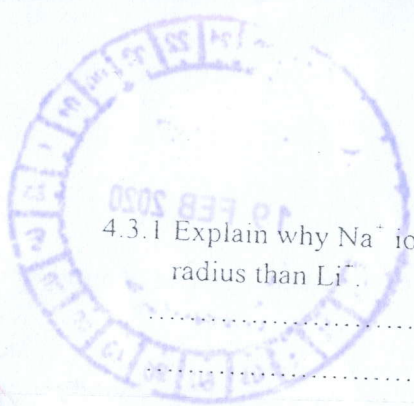
[10 marks]

4.2.3 What is the entropy change?

.....

[07 marks]

70



4.3.1 Explain why  $\text{Na}^+$  ion has higher molar conductivity than  $\text{Li}^+$  ion despite its larger ionic radius than  $\text{Li}^+$ .

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[04 marks]

4.3.2 Explain why a proton has very small ionic radius, but has very high molar conductivity.

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[06 marks]

05. Answer all parts

5.1 If you are asked to monitor an execution of organic synthesis using Thin Layer Chromatography in the laboratory, give the steps you would follow to perform it. (Use diagrams if necessary).

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[05 marks]

5.2 State the nature of the polarities of two phases used in reverse phase Thin Layer Chromatography.

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[05 marks]



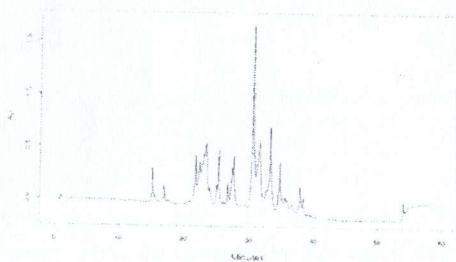
5.3 What is meant by gradient elution in column chromatography?

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[05 marks]

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5.4 Consider the GC chromatogram below:



Give a modification that can be used to improve the peak resolution here.

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[05 marks]

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