FACULTY OF ALLIED HEALTH SCIENCES UNIVERSITY OF RUHUNA
DEPARTMENT OF MEDICAL LABORATORY SCIENCE

First End-Semester Examination – December 2023 – 2021/2022 Batch

MLS1122 Basic Chemistry I - Theory

Date: 19th December 2023   Time: 11.30 am– 12.30 pm

- *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.*
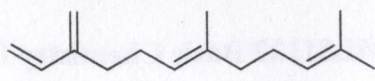

Index Number	....

For Examiner's Use Only

Question No	Marks
1	
2	
3	
4	
Total	
Percentage	

1

01. Answer <u>all</u> parts

1.1 Following is the structure of β-farnesene which can be obtained from cornstarch.

1.1.1 How many geometrical isomers does β–farnesene exhibit?

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(10 marks)

1.1.2 Label the double bonds which show geometrical isomerism and assign (E/Z) designation to them.

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(10 marks)

1.2 Draw the orbital energy diagram of `the C=C double bond.

(30 marks)

2

1.3 Determine the R/S configuration of the following molecule and draw the Fischer projection of its enantiomer.

(30 *marks*)
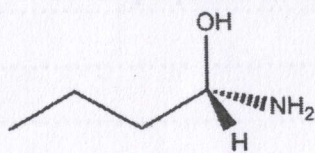
1.4 Given that (S)-bromobutane has a specific rotation of +23.1°, what is the % composition of a mixture whose specific rotation was found to be +18.4°?

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(20 *marks*)
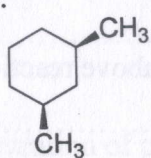
02. Answer all parts.

2.1 Draw the two chair conformations of the following 1,3-dimethyl cyclohexane and state which conformer is more stable.

(20 marks)

3

2.2 Draw the Newman projections for all staggered conformations formed by rotation about the carbon-carbon single bond in 1,2-dibromopropane and indicate the **highest energy conformer.**

(30 marks)

2.3 Identify the strong acid and the strong base of the following acid base reaction and predict the position of equilibrium.

pKa =10

pKa = -1.7

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(20 marks)

2.4 Calculate the equilibrium constant of the above reaction.

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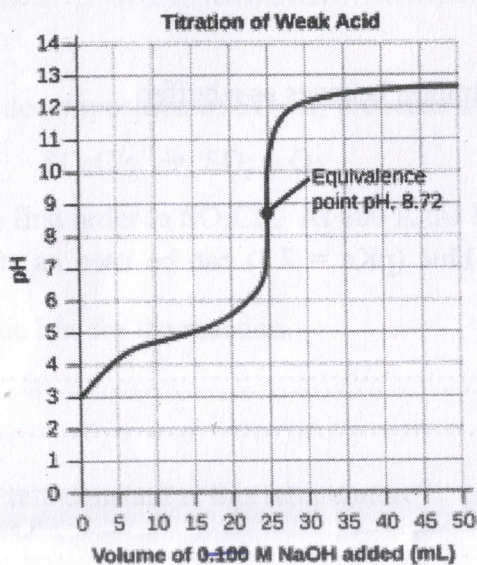
(15 marks)

2.5 A buffer solution was made from ethanoic acid and sodium ethanoate. Explain why there is no significant change in the pH of the buffer, when small quantity of sodium hydroxide is added.

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(*15 marks*)

3. Answer <u>all</u> parts

A 50.00 cm^3 sample of the pentatonic acid was titrated with 0.0400 mol dm^{-3} solution of sodium hydroxide at 25 °C. The titration curve is shown below.

Titration of Weak Acid

Equivalence point pH, 8.72

pH

Volume of 0.100 M NaOH added (mL)

0.04 ₀

3.1 Estimate the pKa of the pentatonic acid using the above titration curve.

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(*20 marks*)

3.2 Calculate the initial H$^+$ concentration of pentatonic acid using the curve.

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(*15 marks*)

3.3 Calculate the molarity of the pentanoic acid.

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(*30 marks*)

3.4 Indicate on the curve where the titration behaves as a buffer.

(*15 marks*)

3.5 Describe whether bromothymol blue (pKa = 7.3) can be used as an indicator for this titration.

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(*20 marks*)

4. Answer all parts

4.1 What is the denticity of ligand ethylenediaminetetraacetic acid (EDTA)?

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(*10 marks*)

4.2 In an analysis a 50.00 cm³ hard water sample required 25.55 mL of the standardized 0.0149 mol dm⁻³ EDTA solution for complete reaction.

4.2.1 Calculate the metal ion concentration in the hard water sample.

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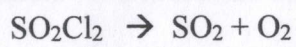
(*20 marks*)

6

4.2.2 Assuming this hardness is caused by dissolved $CaCO_3$ in water, express the hardness in parts per million (ppm) as $CaCO_3$. (FW $CaCO_3$ = 100.09 g/mol)

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(*20 marks*)

4.3 The gas phase decomposition of SO_2Cl_2 proceeds as follows:

$$SO_2Cl_2 \rightarrow SO_2 + O_2$$

The rate law is first order in SO_2Cl_2. At 600 K the half-life of this reaction is 2.3×10^5 s.

4.3.1 Write the rate law for the reaction.

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(*10 marks*)

4.3.2 What is the rate constant at this temperature?

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(*20 marks*)

4.4 What factors determine whether collision between two molecules leads to a chemical reaction?

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(*20 marks*)

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