File 10.

FACULTY OF MEDICINE, UNIVERSITY OF RUHUNA

BSc MLS degree programme
Year end examination year 1 6th Batch June 2015

Chemistry (MLS 1101) theory - structured essay 9.00 – 10.00 am 25th June 2015

6

- *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 .....

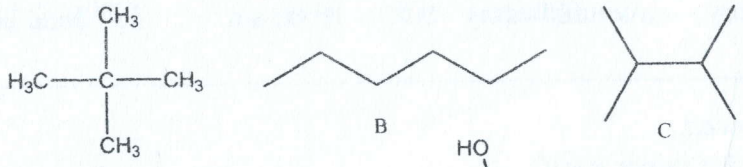
For Examiner's Use Only

Question No	Marks
1	
2	
3	
4	
5	
Total	
Percentage	

6

01. Answer **all** parts.

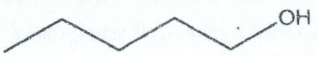
(a) (i) Rank the following compounds in the order of increasing boiling points.



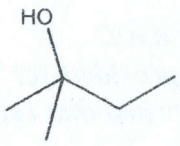
A

B

C



D



E

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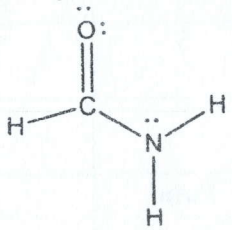
[6 marks]

(ii) Draw the H- bonding in a solution containing C_2H_5OH and H_2O.

[6 marks]

(iii) Write the resonance structures for the following compound and indicate which of the resonance structures are the major contributors.

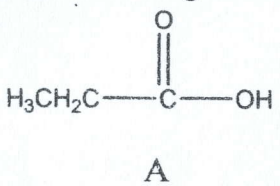


[6 marks]

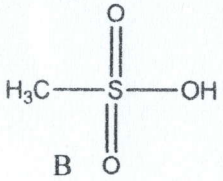
(b) (i) Write down the structures of possible isomers of dibromoethene.
Which of them will have zero dipole moment (μ)?

[6 marks]

(ii) The compound **B** is a stronger acid than the compound **A**. Explain briefly.



A



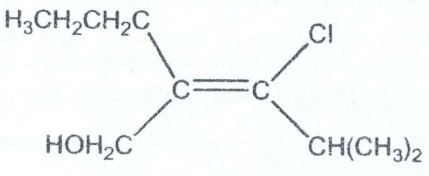
B

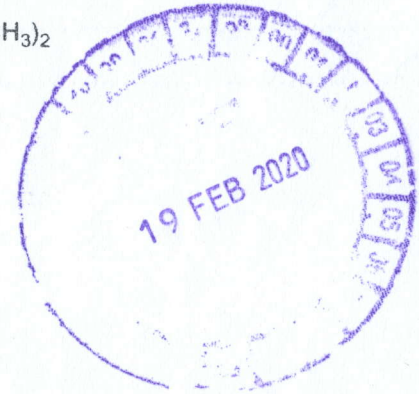
[6 marks]

(iii) Draw the staggered conformations of 2,3-dimethylbutane in the order of increasing energy.

[6 marks]

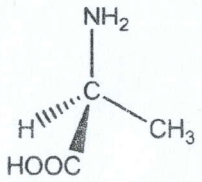
(c) (i) Assign E/Z configuration to the following compound.





[5 marks]

(ii) Draw the Fischer projection of the following compound and name the compound giving (R) or (S) designation .



[12 marks]

(iii) Draw the conformers of trans- 1,2-dibromolcyclohexane and state which conformer is of lower energy.

[7 marks]

02. Answer **all** parts.

(i) A radioactive nuclide which consists of 29 protons and 35 neutrons is used to diagnose liver disease. Write its nuclide symbol in the form of $\frac{A}{Z}X$. Write two other ways to represent this nuclide.

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[03 marks]

(ii) Cobalt-60, which is used in radiation therapy, has a half-life of 5.26 years. If 100.0 mg sample of cobalt-60 is used, how much is left after 26.3 years?

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[05 marks]

(iii) Identifying the products write down the balanced nuclear equations for the following radioactive processes by using the radioactive elements given in the parentheses as the reactants.

(I) Emission of an alpha particle ($^{210}_{84}Po$)

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(II) Emission of a beta particle ($^{131}_{53}I$)

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(III) Emission of a positron ($^{40}_{19}K$)

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(IV) An electron capture ($^{67}_{31}Ga$)

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[*08 marks*]

(iv) What is the difference between artificial and natural transmutation? How would you identify those mutations from an equation?

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[*04 marks*]

03. Answer **all** parts.

(a) A volume of 30.00 mL of 0.1000 *mol dm*$^{-3}$ $NH_3(aq)$ was titrated with 0.2000 *mol dm*$^{-3}$ $HCl(aq)$. The base-dissociation constant, K_b, for NH_3 in water is 1.8×10^{-5} at 25 °C.

(i) Write the net-ionic equation for the reaction of $NH_3(aq)$ with $HCl(aq)$.

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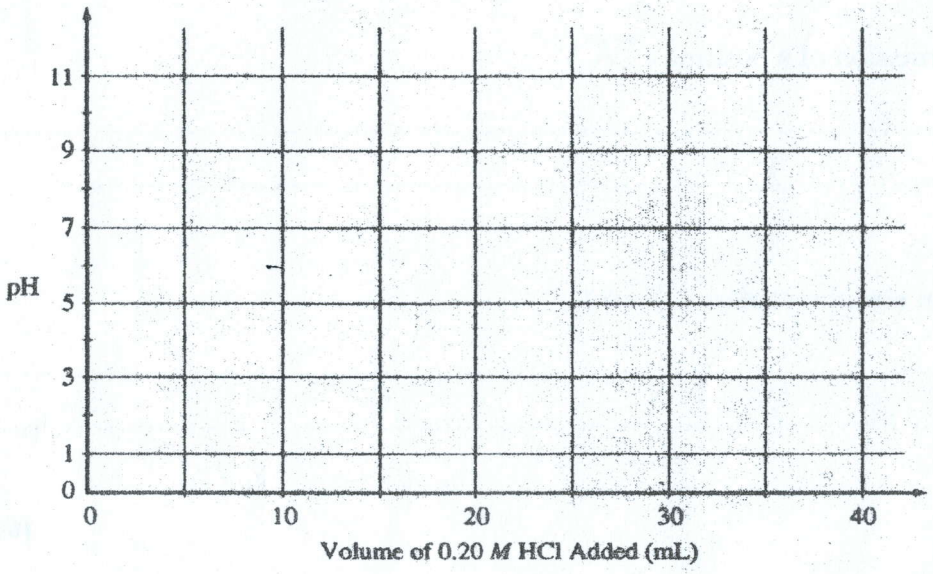
[02 marks]

(ii) Using the axes provided below, sketch the titration curve that results when a total of 40.00 mL of 0.2000 *mol dm*$^{-3}$ *M* $HCl(aq)$ was added to the 30.00 mL volume of 0.10 *mol dm*$^{-3}$ $NH_3(aq)$.



[05 marks]

(iii) From the table below, select the most appropriate indicator for the titration. Justify your choice

Indicator	pK_a
Methyl Red	5.5
Bromothymol Blue	7.1
Phenolphthalein	8.7

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[03 marks]

(b) A 50.00 mL aliquot of a solution containing iron(II) and iron(III) required 13.73 mL of 0.01200 M EDTA when titrated at pH 2.0 and 29.62 mL when titrated at pH 6.0.

(i) Write chemical equations and equilibrium constant expressions for the formation of both EDTA complexes of iron.

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[04 marks]

(ii) Express the concentration of the solution in terms of the parts per million of <u>each ion</u>. Note that trivalent cations form more stable complexes and divalent cations, form unstable complexes at very low pH.

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[06 mark]

(c) What types of electronic transitions would be possible for the following compounds?

(i) Cyclohexane
(ii) Dimethyl ether
(iii) Napthalene

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[04 marks]

(d) The UV spectrum of acetone shows absorption maxima at 166, 189, and 279 nm. What type of transition is responsible for each of these bands?

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[03 marks]

(e) A 3.25×10^{-5} *mol* dm^{-3} unknown solution has a transmittance of 18.4% when measured in a 1.0 cm cell at a wavelength of 525 nm. Calculate the absorbance of this solution.

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[03 marks]

(f) A 5.00-mL sample of blood was treated with trichloroacetic acid to precipitate proteins. After centrifugation, the resulting solution was brought to a pH of 3 and was extracted with two 5-mL portions of methyl isobutyl ketone containing the organic lead complexing agent APCD. The extract was aspirated directly into an air-acetylene flame yielding an absorbance of 0.444 at 283.3 nm. Five-milliliter aliquots of standard solutions containing 0.250 and 0.450 ppm Pb(II) were treated in the same way and yielded absorbance values of 0.396 and 0.599.

(i) Give a series of reactions to show the processes leading to free gaseous lead atoms from lead complex PbL.

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[04 marks]

(ii) Calculate the concentration Pb (ppm) in the blood sample.

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[06 marks]

04. Answer **both** parts

(a) (i) Biologists deal with the terms, endergonic and exergoinc, when they study the biological reactions while chemists and physicists use the terms, endothermic and exothermic, for chemical reactions. Distinguish those terms.

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[10 marks]

(ii) First law and second law of thermodynamics account the accompanying energy changes and disordering or ordering pattern of a system due to a chemical process.

(I) Explaining all the terms with sign convention, give the mathematical expression for the first law of thermodynamics.

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(II) Under which conditions that the equation for work done $w = -nRT \ln \frac{V_f}{V_i}$, could be used?

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(III) Write the general equation for the entropy change of the system in above(II)

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[15 marks]

(iii) Three moles of an ideal gas in an initial state of 100 K and 2 dm^3 volume were isothermally expanded to tenfold of its initial volume.

(I) Calculate the work done by the system.

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(II) What is the heat change in the system?

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(III) What is the entropy change?

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[15 marks]

(b) (i) Explain the osmosis and osmotic pressure.

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[05 marks]

(ii) In an experiment carried out to determine the molar mass of a protein, the osmotic pressure was found to be 1.15 kPa at 25 °C , when 100 cm^3 of solution contained 1.1 g of the protein. Calculate the molar mass of the protein.

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[15 marks]

05. Answer **all** parts.

(a) Based on which phenomena, components in a mixture are distributed between the two phases in Thin Layer Chromatography?

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[04 marks]

(c) Define the term "retention time" used in Gas Liquid Chromatography.

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[03 marks]

(c) What do you mean by isothermal elution and temperature programming used in Gas-Liquid chromatography?

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[06 marks]

(d) State a suitable chromatographic method that can be used to analyze a mixture of amino acids. Name the visualizing method/reagent employed in the above mentioned method.

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[04 marks]

(e) What is the theory behind Size–Exclusion chromatography?

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[03 marks]

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