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FACULTY OF MEDICINE, UNIVERSITY OF RUHUNA

B.Sc. Medical Laboratory Science Degree Programme
Year End Examination Year 1 - 8th Batch - 2017
Chemistry (MLS 1101)

02nd January 2017

~~9.00 a.m. – 10.00 a.m.~~ 8.30 am - 9.30 am

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TIME: One (01) hour

- *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 .....

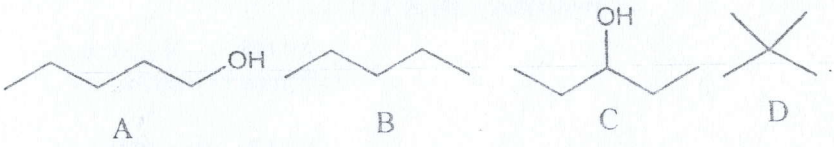
For Examiner's Use Only

Question No	Marks
1	
2	
3	
4	
5	
Total	
Percentage	

51

01. Answer all parts.

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

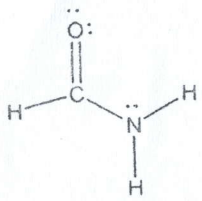


[06 marks]

(ii) Show the H- bonding occurs in a solution containing C_3H_7OH and H_2O.

[06 marks]

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

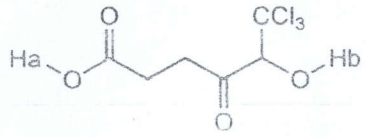


[06 marks]

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

[06 marks]

(ii) Determine which proton (H_a or H_b) is more acidic and explain how you would arrive at your answer.

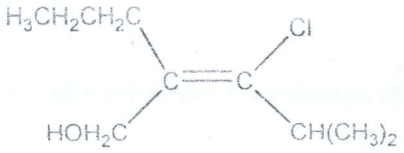


[06 marks]

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

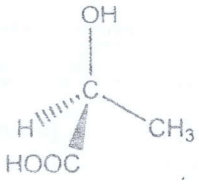
[06 marks]

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



[05 marks]

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



[12 marks]

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

[*07 marks*]

02. Answer **all** parts.

(a) (i) Define each of the following radioactive decay processes and give a suitable example for each:

(I) Alpha emission

(II) Positron emission

(III) Electron capture

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[*06 marks*]

(ii) Write the balanced nuclear equation for each of the following decays:

(I) β^- decay of actinium-228

(II) α decay of radon-212

Note: The atomic numbers of actinium and radon are 89 and 86 respectively.

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[*04 marks*]

(iii) Give the radioactive element used to destroy cancer cells and mention the drawback of it.

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[04 marks]

(iv) If the $^{14}_{6}C$ from recently cut down wood decays at the rate of 15.4 disintegrations per minute per gram of carbon, what is the approximate age of the artifact which has been found to give 3.85 disintegrations per minute per gram of carbon? (The half-life of $^{14}_{6}C$ is found to be 5730 years).

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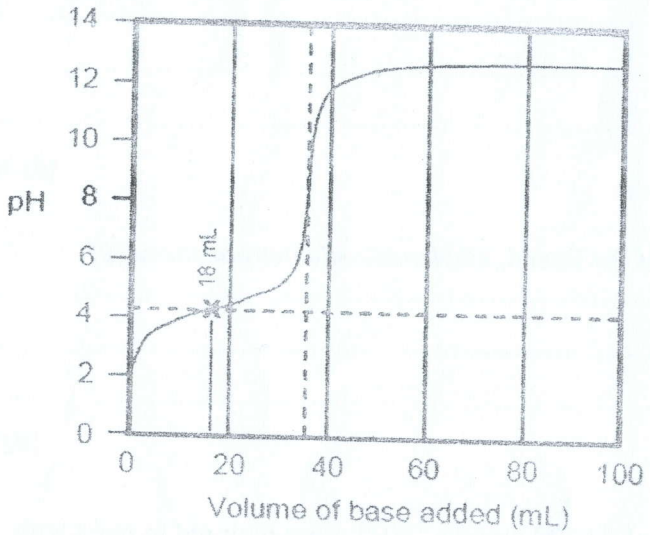
[06 marks]

03. Answer **all** parts.

(a) (i) A 0.446-g sample of an unknown monoprotic acid is titrated with 0.1050 *mol dm*$^{-3}$ KOH. The resulting titration curve is shown below. Determine the molar mass and estimate the p*Ka* of the acid.



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[*08 marks*]

(ii) Indicate whether the indicator methyl red ($pK_a = 5.1$) is suitable for this titration.

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[*02 marks*]

(b) (i) Name the most widely used titrant in complexometric titrations.

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[*01 mark*]

(ii) How do you detect the equivalence point in complexometric titrations?

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[*02 marks*]

(iii) What is the denticity of the ligand, *ethylenediaminetetraacetic* acid?

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[*01 mark*]

(iv) How many milliliters of 0.0500 *mol* dm^{-3} EDTA are required to react with:

(I) 50.0 mL of 0.0100 *mol* dm^{-3} Ca^{2+}?

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(II) 50.0 mL of 0.0100 *mol dm*$^{-3}$ Al^{3+}?

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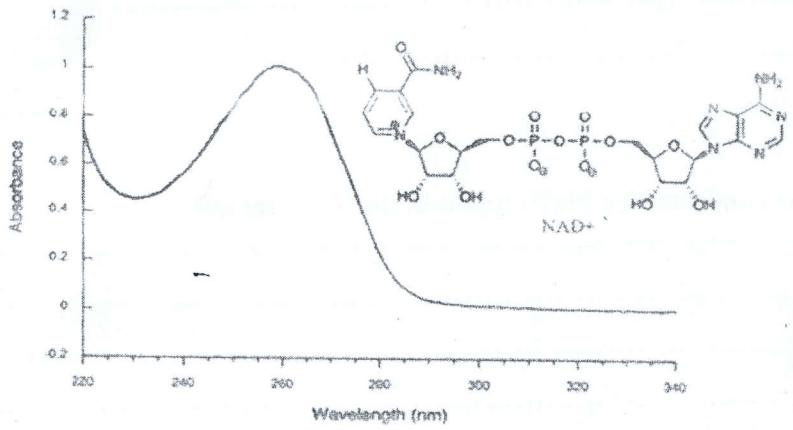
[06 marks]

(c) Given below is the absorbance spectrum of an important biological molecule, nicotinamide adenine dinucleotide, abbreviated as NAD^+



(i) What is the wavelength at maximum absorbance (λ_{max})?

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[03marks]

(ii) Estimate the absorbance at λ_{max} in this spectrum.

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[03marks]

(iii) Express the absorbance at λ_{max} in terms of percent transmittance (%T)

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[04marks]

48

(d) 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 were 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(II) (ppm) in the blood sample.

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[06 marks]

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

(a) The First law and second law thermodynamics account for 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 entropy change for the system in (ii) above.

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[25marks]

(b) Three moles of an ideal gas in an initial state of 200 K and 2 dm^3 volume were isothermally expanded to a final volume of 20 dm^3.

(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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[25 marks]

(c) (i) What is osmosis and osmotic pressure?

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[04 marks]

47

(ii) Calculate the molar mass of the protein if the osmotic pressure at 25 °C is 1.15 kPa, when 1.1g of a protein was dissolved in 100 cm^3 of solution?

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[06 marks]

05. Answer all parts.

(a) What is the application of preparative TLC?

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[05 marks]

(b) State the polarities of the phases in normal phase chromatography.

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[05 marks]

(c) What is meant by 'wet loading' in column chromatography?

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[05 marks]

(d) Name two categories of columns used in Gas-Liquid Chromatography.

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[05 marks]

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