B.A. / B.Sc. PART I EXAMINATION, 2020
FAKIR CHAND COLLEGE CENTRE (551)

INSTRUCTIONS FOR CANDIDATES

READ ALL THE INSTRUCTIONS CAREFULLY BEFORE WRITING ANSWERS

1. Total **TIME OF EXAMINATION: 4 HOURS**
2. **Question Paper Comprises Of Two Separate Questions – Paper IA & IB. Candidates Must Have To Answer IA and IB Separately And Have To Prepare Two Separate pdf Files By Scanning All The Papers Clearly And Serially (According To Page Numbers). The Two pdf files Have To Upload Separately In The 'ADD FILE' Menu Of the Google Form For Submission.**
3. **ATTACH THE UNIVERSITY REGISTRATION CERTIFICATE** As The Last Page Of The pdf File
4. Use Only **WHITE PLAIN A4 PAPERS** For Writing Answers
5. Use **ONLY BLACK INK** For Writing Your Answers
6. Give **A TOP PAGE** With Clear Mention Of University **REGISTRATION NO.**
7. **GIVE PAGE NO.** At The Top Right/Middle Of Each Page
8. Give **AT LEAST 1CM MARGINS** In All The Four Sides Of Each Page

2020
B.A. /B.Sc. Part I Examination
University of Calcutta
CHEMISTRY – HONOURS
Paper : IA
F.M. 50

FAKIR CHAND COLLEGE CENTRE(551)

Answer ANY FOUR from Question Nos. 1 to 6. Brief and to the point answer is desirable.

1. a) Draw the energy profile diagram for rotation around C_2-C_3 bond of *meso*-2,3-butanediol with proper labelling. $7^1/_2$

   b) Write the Fischer projection formula of *meso*-tartaric acid and represent it in Newmann projection. $2^1/_2+2^1/_2$

2. a) Draw the stable conformers of 1,2-dichloroethane and 1,2-difluoroethane with explanation. $7^1/_2$

   b) Define with example: Atropisomerism. 5

3. a) Compare the basicities of methylamine, dimethylamine and trimethylamine in aqueous and non-aqueous media. $7^1/_2$

   b) Which compound has higher dipole moment, butane-2,3-dione and cyclopentane-1,2-dione? Give reason. 5

4. a) Arrange the following compounds in increasing order of acid strength with explanation.

   (i) 4-nitrophenol (ii) 2,6-dinitrophenol (iii) 3,5-dimethyl-4-nitrophenol $7^1/_2$

   b) Compare the basicities of urea and guanidine. 5

5. a) The substitution reaction of $EtSCH_2CH_2Cl$ with ethanol proceeds at a rate many fold faster than similar reaction of $EtOCH_2CH_2Cl$. Explain. $7^1/_2$

   b) Define pericyclic reaction and illustrate with a suitable example. 5

6. a) Draw all the pi molecular orbitals of 1,3-butadiene in the *cisoid* conformation. Arrange them in order of increasing energy levels, designating the HOMO and LUMO in the ground state. $7^1/_2$

   b) Write down the steps for the resolution of (±)2-butanol. 5

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*Answer briefly **any four** questions from the following question no. 1 – 6 :*

1. a) Evaluate the most probable velocity, C_m from the Maxwell's speed distribution in three dimensions.

Given $\frac{dn_c}{dc} = 4\pi n\left(\frac{m}{2\pi kT}\right)^{\frac{3}{2}} c^2 e^{-\frac{mc^2}{2kT}}$ 5

b) The Maxwell's normalized probability distribution for velocity 'u' of gas molecules in one dimension is $P(u) = A^{\frac{1}{2}} \exp\left(\frac{-mu^2}{2k_BT}\right)$. Comment on the area under the curve by drawing a schematic diagram of the velocity distribution plots at two different temperatures. 7½

2. a) Explain why Equipartition principle predicts more correct values of heat capacity for *'He'* compared to *'HCl'* at room temperature. 5

b) Derive the van der Waal's equation in virial form and find out expression of Boyle temperature from the second virial coefficient. 7½

3. a) Classify the following as extensive and intensive properties:
Chemical potential, density, enthalpy, specific heat and Helmholtz free energy. 5

b) Derive thermodynamically the relation $C_P - C_V = \left[p + \left(\frac{\partial U}{\partial V}\right)_T\right]\left(\frac{\partial V}{\partial T}\right)_P$ and calculate its value for a gas obeying the equation of state $P(V-b) = nRT$. 7½

4. a) Derive *Gibbs- Helmholtz equation*. 5

b) How would a *Carnot cycle* look in a *T-S diagram*? Label the states and various processes involved. What does the enclosed area signify? 7½

5. a) Draw rate versus time profile for (i) zero order and (ii) first order reaction. 5

b) Methyl acetate was hydrolyzed to acetic acid and methanol by *1(N) HCl* as catalyst. Aliquots of equal volume were removed the following intervals and titrated with a solution of *NaOH.*

Time (min)	*0*	*5*	*15*	*∞*
NaOH (ml)	*24.0*	*27.0*	*31.4*	*40.0*

Show that it is a first order reaction and evaluate the average life period of the reaction in minute. 7½

6. a) Calculate the activation energy of reaction whose reaction rate at *300 K* get doubled for *10* degree rise in temperature. *($R = 8.3145\ JK^{-1}mol^{-1}$)* 5

b) Derive *Michaelis-Menten* equation for enzyme catalyzed reaction. 7½