COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY (PRACTICAL)

PHYSICAL CHEMISTRY-III

CORE-8

Time Allotted: 3 Hours   Full Marks: 15

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

Experiment No. 1

Estimate the value of rate constant (k) for the acid hydrolysis of Methyl acetate at room temperature.

[Two readings at two time intervals after initiation of the reaction are taken]

(i)	Working formula and significance of the terms involved	2
(ii)	Mention the order of the reaction and record the temperature	$\frac{1}{2}+\frac{1}{2}=1$
(iii)	Prepare NaOH solution	1
(iv)	Presentation of data in Tabular form	4
(v)	Calculate the rate constant	2
(vi)	Accuracy	2
(vii)	Signed LNB submission	1
(viii)	Viva-voce	2

Experiment No. 2

Study the absorption of acetic acid on charcoal. With the help of Freundlich's adsorption isotherm find out the value of $\frac{1}{n}$ (Power of dependence of adsorption per unit mass on concentration.)

[At least two sets of different composition are prepared and three readings in each composition should be taken.]

Following points to be noted:

(i)	Working formula and significance of the terms involved	2
(ii)	Recording of temperature	$\frac{1}{2}$
(iii)	Preparation of two sets of compositions	2
(iv)	Presentation of data in tabular form	3
(v)	Result calculation	$2\frac{1}{2}$
(vi)	Accuracy of the result	2
(vii)	Signed LNB submission	1
(viii)	Viva-voce	2

——×——

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY

PHYSICAL CHEMISTRY-III

CORE-8

Time Allotted: 2 Hours   Full Marks: 25

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***ten*** questions from the following: $1 \times 10 = 10$

  (a) Explain surface Zeta-potential and its significance in colloidal stability.

  (b) Find the unit of $\dfrac{d \ln k}{dT}$ for n^{th} order reaction.

  (c) Write down the significance of BET adsorption isotherm.

  (d) Draw (112) plane of a cubic unit cell.

  (e) Are molecularity and order of a reaction same? Explain critically.

  (f) The catalyst does not affect the final state of equilibrium. — Comment.

  (g) What do you mean by number of components of a system?

  (h) State the Nernst distribution law.

  (i) How many axes of symmetry are possible for $HgCl_2$ molecule?

  (j) What is 'turn over number'? Explain.

  (k) A chemical reaction is in equilibrium condition — Explain briefly in terms of rate of the reactions.

  (l) What do you meant by Flocculation value?

  (m) What is coagulation of a colloidal system?

GROUP-B

Answer any *one* question from the following $5 \times 1 = 5$

2. Draw the miscibility phase diagram of phenol–H_2O system (at constant pressure). Calculate the number of degrees of freedom of the system at CST. Mention the physical significance of CST. Discuss the effect of pressure on CST for the above system.   2+1+1+1

3. (a) Discuss the kinetics of enzyme-catalysed reactions and derive the expression of Michaelis-Menten constant applying steady state approximation.   2

(b) Calculate the surface area of Ni-catalyst that adsorb 103 cc of N_2 gas at NTP per gram in order to form monomolecular layer. (Given the effective area occupied by each N_2 molecule on the surface is 0.162 nm^2) — 3

4. (a) The rate of change of molar concentration of CH_3 radicals in the reaction — 3

$2CH_3(g) \rightarrow CH_3CH_3$ was reported as $d[CH_3]/dt = -1.2$ mol $dm^{-3}s^{-1}$ under particular conditions. What is (i) the rate of reaction and (ii) the rate of formation of CH_3CH_3.

(b) Freundlich adsorption isotherm is a special case of Langmuir adsorption isotherm. Explain. — 2

GROUP-C

Answer any *one* question from the following $10 \times 1 = 10$

5. (a) What is the maximum wavelength of X-ray that may be used of Bragg's analysis of a crystal with interplaner spacing 3.45Å. — 2

(b) The surface tension of water follows a linear dependence on the concentration of a solute and is reduced by six units at 0.02 M at 27°C. Calculate surface for 0.0005 M solution. — 2

(c) State and explain Schulze-Hardy rule for coagulation of colloids. How can you prevent coagulation of a colloidal system? — 3

(d) What is micelles and CMC? — 1

(e) What are point groups and space groups? How many point groups and space groups are theoretically possible? — 2

6. (a) Thermodynamically derive 'Nernst distribution law'. — 2

(b) Derive Langmuir adsorption isotherm equation. — 3

(c) Although KCl has the same relative arrangement of ions, the X-ray diffraction pattern is different for KCl than $NaCl$. Explain why? — 2

(d) The first order rate constant (k) of a reaction $A \rightarrow P$ follow the equation — 3

$$\log k(\text{min}^{-1}) = 33.91 - \frac{18000}{T}$$

How long it will take for one mole of 'A' to decompose 70% at 227°C? Calculate the activation energy.

——×——

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY (PRACTICAL)

INORGANIC CHEMISTRY-III

CORE-9

Time Allotted: 3 Hours　　　　　　　　　　　　　　　　　　Full Marks: 15

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

1. Estimate gravimetrically the amount of Ni(II) present in supplied aliquot using dimethyl glyoxime as precipitant.

   (a) Write down the theory with chemical equation and signed it by the examiner.　3

   (b) Record the experimental data in tabular form. All experimental data should be signed by the examiner.　2

   (c) Calculation　2

   (d) Accuracy　3

2. Laboratory Note Book　2

3. Viva-voce　3

——×——

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY

INORGANIC CHEMISTRY-III

CORE-9

Time Allotted: 2 Hours   Full Marks: 25

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All the symbols have their usual significance.

Answer Question No. 1 from group-A and *one* question from each group

GROUP-A

1. Answer any ***ten*** questions from the following: $1 \times 10 = 10$

(a) What is the magnetic moment of Fe in brown ring complex?

(b) Draw the possible isomers of $[Co(en)_3]^{3+}$.

(c) Arrange the complexes in order of their molar conductivities:

$$Pt(NH_3)_6 Cl_4 \ ; \ K_2PtCl_6 \ ; \ Pt(NH_3)_3 Cl_4$$

(d) Which of the following complexes are expected to show Jahn-Teller distortion?

$$[CuCl_6]^{4-} \text{ and } [Cr(acac)_3]$$

(e) Find out the magnetic moment of $[Ni(CO)_4]$.

(f) Mention the name of the metal ion present in Vitamin B_{12}.

(g) State the biological function of Fe-S protein.

(h) Give the electronic configuration of gadolinium.

(i) Distinguish between chelating ligand and bridging ligand.

(j) Give one example of Cu containing metallo-enzyme.

(k) What is the theoretical basis of nephelauxetic series of ligands?

(l) What is orbital selection rule?

GROUP-B

Answer any *one* question from the following $5 \times 1 = 5$

2. (a) Calculate CFSE in kJ/mol for $[Ti(H_2O)_6]^{3+}$ ion for which d-d transition is single broad absorption peak with a maxima at $20300 \ cm^{-1}$.   3

(b) $[Co(NH_3)_6]^{3+}$ is more stable than $[Co(NH_3)_6]^{2+}$ — Why?   2

3. (a) Explain the stepwise stability constants and overall stability constant of a complex with an example of your choice. How are they related?   2

   (b) How does arsenic exert toxic effect on biological system? How the toxicity can be removed?   3

4. (a) Elucidate the terms: (i) Apoenzyme (ii) Holoenzyme (iii) Co-enzyme   3

   (b) $[Cr(en)_2Cl_2]Cl$ can be found in two forms, one violet and other green. On reaction with oxalate ion the violet species produces corresponding oxalate derivative, while the green one does not. — Explain the result and write the IUPAC name of the oxalate derivative.   2

GROUP-C

Answer any *one* question from the following $10 \times 1 = 10$

5. (a) On the basis of CFSE values predict which of the oxides viz Mn_3O_4 and Fe_3O_4 is a simple spinal and which one is an inverted spinal?   5

   (b) Calculate CFSE for $[FeF_6]^{3-}$ and $[Fe(CN)_6]^{4-}$. $2\frac{1}{2}$

   (c) How d-orbital splitting in a linear complex takes place? $2\frac{1}{2}$

6. (a) How does 'Bohr effect' facilitates the transfer of oxygen from haemoglobin to myoglobin?   3

   (b) Discuss ion exchange method for separation of lanthanides.   4

   (c) Draw graphically the nature of variation of magnetic susceptibility with temperature for ferromagnetic, antiferromagnetic and paramagnetic substances.   3

7. (a) Discuss the colour and spectral behaviour of actinides.   3

   (b) What are the effects of Zn^{2+} ion deficiency in human beings?   2

   (c) Using Orgel diagram draw ligand field spectra of $[Ti(H_2O)_6]^{3+}$ complex.   2

   (d) The oxides of formula MO which all have octahedral coordination of the metal ions have the following lattice enthalpies —   3

CaO	TiO	VO	MnO	
3460	3878	3913	3810	kJ/mol

   Account for the trends in terms of the CFSE.

——×——

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY

ORGANIC CHEMISTRY-IV

CORE-10

Time Allotted: 2 Hours   Full Marks: 25

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP-A

Answer any *ten* questions from the following $1\times10 = 10$

1. (a) What do you mean by 1,3-diaxial interaction?

   (b) Write the name and structure of an amino acid having secondary amine group.

   (c) What is the structural difference between cellulose and starch?

   (d) What is the 'Sanger reagent'?

   (e) Draw the boat form of cyclohexane in Newman projection formula.

   (f) Mention the difference between DNA and RNA with respect to their structure.

   (g) Draw the structure of α-D-glucopyranose in the Haworth Projection formulae.

   (h) Which protein is responsible for muscle contraction and cell movement?

   (i) Give an example of catalytic proteins.

   (j) Draw the most stable conformations of *cis*-1,3-dihydroxycyclohexane. Explain.

   (k) What will be the mononitration product of the following compound?
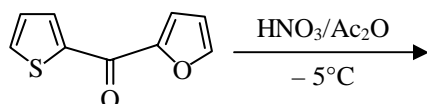
   (l) Write the structure of the product(s) formed when furfural is treated with $NaOH$.

GROUP-B

Answer any *one* question from the following   5×1 = 5

2. (a) Electrophilic substitution reaction is uncommon for pyridine. Explain.   2

   (b) Compare and explain the dipole moments between furan, pyrrole and thiophene.   2

   (c) Give the structure of thymidine monophosphate.   1

3. (a) Aldopentose act as a precursor for the preparation of furfural. State the reaction condition and show the mechanism.   3

   (b) Discuss the azalactone method for the synthesis of phenyl alanine.   2

GROUP-C

Answer any *one* question from the following   10×1 = 10

4. (a) Give the mechanism of the reaction of glucose with an excess of phenylhydrazine.   3

   (b) How leucine is obtained by the Gabriel synthesis?   2

   (c) How the N-terminal residues of the peptide can be determined?   2

   (d) Explain, why electrophilic substitution of indole takes place at 3-position and nucleophilic substitution of pyridine at 2-position.   3

5. (a) Show the steps for the Bischler-Napierialski synthesis of 1-methylisoquinoline starting from phenyl ethyl amine and suitable reagents.   2

   (b) Draw the most stable conformer of *trans*-1,4-difluoro cyclohexane. Explain with proper justification.   2

   (c) How would you convert D-glucose to D-fructose?   2

   (d) Explain the Ninhydrin test with the mechanism.   3

   (e) Draw the most stable chair conformation of the following compound.   1
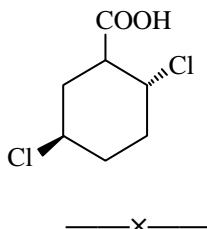
COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY (PRACTICAL)

ORGANIC CHEMISTRY-IV

CORE-CC10

Time Allotted: 3 Hours   Full Marks: 15

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All the symbols have their usual significance.

1. Perform the organic preparation according to the direction given. Submit the crude product. Report the yield of the dried crude product.   10

2. Laboratory note book   2

3. Viva-voce   3

——×——

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 4th Semester Examinations, 2022

CHEMISTRY (METHOD)

CORE-CC10

Time Allotted: 3 Hours   Full Marks: 15

Candidates are required to give their answers in their own words as far as practicable.
All the symbols have their usual significance.

Methods for the Organic Preparation

Students will follow the preparation method as per the lottery selection.

Method 1 (For the Sample Ax):

Disolve the mixture the given compound marked 'A' and 1 g anhydrous Na_2CO_3 in 25 ml water in a 100 ml beaker by gentle warming until clear solution results. Then cool the solution nearly 15°C and add slowly the $NaNO_2$ solution (1 g in 3-4 ml water). Pour the solution slowly into a 250 ml beaker containing 3 ml conc. HCl and 15 g crushed ice. Dropwise add the solution of 1.6 ml N,N-dimethylaniline in 1 ml glacial acetic acid to the diazotized solution with vigorous stirring. Allow the mixture to stand for 10 minutes and then add about 9 ml of 20% (w/v) of NaOH with stirring; heat the mixture to its boiling point and add 5 g of NaCl and continue heating at 80-90°C until the salt dissolves. Allow the mixture to cool undisturbed for 15 minutes and then cooled in ice salt bath. Filter the solid under suction and wash with cold brine solution. Dry the product carefully on a steam bath and record the yield.

Method 2 (For the Sample Bx):

Take 5 ml of 4% aqueous formaldehyde solution in a 100 ml beaker. To this add the given compound marked 'B'. Stir with a glass rod to make saturated solution. Add a few drops of conc. H_2SO_4 and stir vigorously till a white mass is formed. Filter the residue and wash it several times with distilled water to remove any acid. Dry the residue in filter paper or in an oven and record the yield.

——×——