Total No. of Printed Pages: 2

SUBJECT CODE NO: - FF-6530
FACULTY OF SCIENCE AND TECHNOLOGY
M.Sc. (Sem-I) (Chemistry)
Examination January-2023
Inorganic Chemistry - CHE 102

[Time: 3:00 Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N. B
1. Q.No.1 is compulsory.
2. Attempt any five questions from Q.No.2 to 8.
3. Figures to right indicate full marks.

Q1 Answer the following 20

i) What do you mean by symmetry operations and symmetry elements?
ii) What is mean by reducible representation?
iii) Explain 'Axis of symmetry' with suitable examples.
iv) Find the matrix representation for C_2 and S_2 operations.
v) Calculate the order of C_{4v} point group.
vi) What is acid hydrolysis in metal complexes?
vii) Distinguish between labile and insert metal complexes
viii) Define stability constant of metal complexes.
ix) Give the functions of calcium metal in biological system.
x) What is the role of myoglobin in human body?

Q2 Answer the following 12

a) What is mean by centre of symmetry? Identify the centre of symmetry in Hcl, H_2O, trans $C_2H_2Cl_2$, CO_2 and benzene molecules.

b) What is meant by point group? Identify the point group of NH_3, BF_3, Co_2, CH_4 and Chlorobenzene

Q3 Answer the following 12

a) Prove diagrammatically the $[ptcl_4]^{2-}$ ion has S_4 axis of symmetry.

b) Write a note on 'Direct product of irreducible representation'.

Q4 Answer the following 12

a) Construct the character table for C_{3v} point group using suitable rules.

b) What are the mulliken symbolism rules for irreducible representation? Explain it by using suitable examples.

Q5 Answer the following 12

a) What is base hydrolysis? Discuss the conjugate base mechanism with suitable reaction of metal complex.

b) Describe the SN^1 and SN^2 reaction mechanism of octahedral complex with suitable example,

Q6 Answer the following 12

a) How formation constant of binary complex is determined by using PH metric technique.

b) Enlist the factors affecting the stability of metal complexes. Explain each factor in brief.

Q7 Answer the following 12

a) Give the therapeutic uses of Iron, Copper and zinc.

b) What are metalloporphins? Explain it with reference to Haemoglobin.

Q8 Answer the following 12

a) Explain the outer sphere electron transfer reaction mechanism in octahedral complex with suitable example.

b) Describe the role of any five trace elements in biological system. Give their causes of deficiency.

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SUBJECT CODE NO: - FF-6609
FACULTY OF SCIENCE AND TECHNOLOGY
M.Sc. (Sem-I) (Chemistry)
Examination January-2023
Physical Chemistry - CHE -104

[Time: 3:00 Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N. B
1) Questions No 1 is compulsory.
2) Attempt any five question from questions No 2 to 8.
3) Figures to right indicate full marks.
4) use of now programmable calculator is allowed.

Q1 Attempt all the questions in brief: 20

i) The vapour pressure of liquid nitrogen is 2.06 at O^0C and molar volume at these conditions is 4.65 lit mol^{-1} calculate fugacity of liquid nitrogen at 0^oC (Given R=0.082 lit atm deg^{-1} mol^{-1})
ii) Discuss in brief Nernst heat theorem.
iii) Define surfactants. Explain brief cationic and anionic surfactants.
iv) How will you explain the term diffusion current (id)
v) How will you explain Wein effect.
vi) Show graphically the effect of ionic strength on the rate constant.
a) $Z_A Z_B = 0$, b) $Z_A Z_B = -1$, c) $Z_A Z = +1$
vii) The p^H of a solution is 6.495, calculate the hydrogen ion concentration of the solution.
viii) Write a note on secondary salt effect.
ix) What are disadvantage of dropping mercury electrode.
x) Explain partial molar volume.

Q2 a) What are short coming of Lindemann theory? How are they overcome in Hinshelwood theory. 06
b) Discuss statistical mechanical derivation of the rate constant of a gaseous bimolecular reaction. 06

Q3 a) Describe the method for the determination of the absolute entropies of solids, liquids and gases. 06
b) What are partial molar properties? 06
Give its significance and explain any one method to determine partial molar properties.

Q4 a) Describe in brief the pressure difference across curved surface. 06
b) Discuss critical micellar concentration (CMC). What are the factors affecting CMC. 06

Q5 a) Calculate the activity 06
Coefficient of potassium and sulphate ions in 2 mm aqueous solution of $K_2\ S0_4$.
Using these values, calculate the mean ionic activity coefficient.

b) What do you mean by electrocapillary curves? Draw the electrocapillary curves for solutions. Containing surface active molecular, cations and onions. 06

Q6 a) What should be the p^H of a solution obtained by missing 5gm of acetic acid and 7.5 gm of sodium acetate and making the volume equal to 500ml. Dissociation constant of acetic acid at 25°C is 1.75×10^{-5}. 06

b) Write a note on binding of oxygen by myoglobin and haemoglobin. 06

Q7 a) Describe the flash photolysis method for studying kinetics of fast reactions. 06

b) Calculate free energy change accompanying the composition of one mole of oxygen gas at 0°C from 50 to 200 atmosphere. The frugalities of the gas at 0°C are 48 and 174 atmosphere respectively at pressures 50 and 200 atmospheres. 06

Q8 a) Explain in brief asymmetric effect and electrophoretic effect acting on ions in solution. 06

b) What are the postulates of BET equation? How it is used for the determination of surface area of adsorbent. 06

Total No. of Printed Pages: 3

SUBJECT CODE NO: - FF-6565
FACULTY OF SCIENCE AND TECHNOLOGY
M.Sc. (Sem-I) (Chemistry)
Examination January-2023
Organic Chemistry - CHE -103

[Time: 3:00 Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N. B
1) Question 1 is compulsory.
2) Attempt any 5 questions from 2 to 8.
3) Figures to the right indicate full marks.

Q1 Answer the following questions in brief. (two marks for each question) **20**

i) Explain Keto-enol tautomerism with example.
ii) Define Huckel rule.
iii) Explain why signlet dichlorocarbone is more stable than triplet.
iv) T-Butyl group is used to lock the ring flipping justify.
v) Explain in brief prochirality.
vi) Meso- tartaric acid io optically inactive, explain.
vii) Explain in brief optical purity.
viii) Hexahelicene is Chiral? Explain.
ix) SE^1 mechanism is analogous to SN^1 mechanism justify.
x) Explain why the trans isomer (I) undergo acetolysis 670 times faster than the cis isomer (II).

(I)

(II)

Q2 Solve the following questions. **12**

a) Explain hyperconjugation with suitable example.
b) Write a note or electron donor accepter compounds.
c) Give the physical significance of the term σ (sigma) and ϱ (rho).

Q3 Solve the following **12**

a) Explain with suitable example, how product analysis helps to predict the mechanism?
b) What are cyclodextrins? Give some applications of cyclodextrins.

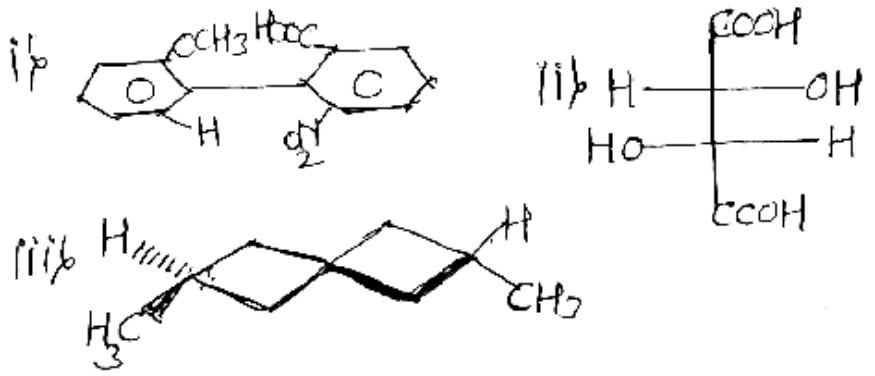
c) Draw the π molecular orbitals of 1, 4- butadiene with increasing order of their energy. Provide HOMO and LUMO labels to the orbital.

Q4 Solve the following. **12**

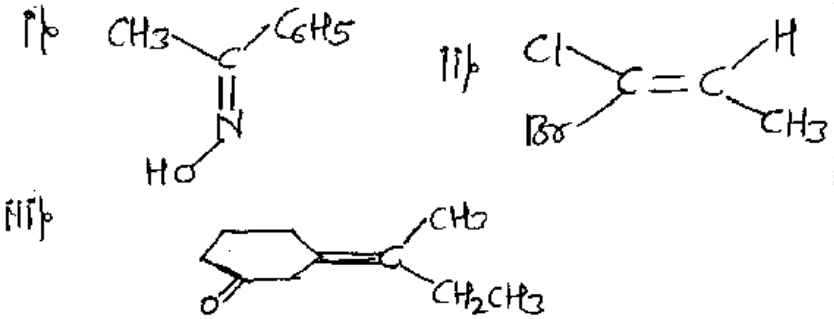
a) Explain Hammond Postulate.
b) Give the generation methods of carbene intermediate. Discuss their stability.
c) Explain with suitable example Kinetic and thermodynamic control.

Q5 Solve the following. **12**

A) Assign R15 configuration for the following.

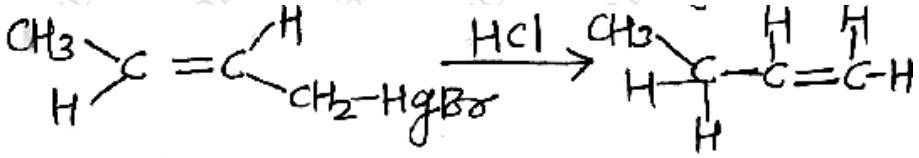


B) Assign E/Z nomenclature to the following



Q6 Solve the following. **12**

a) Suggest the mechanism for following reaction



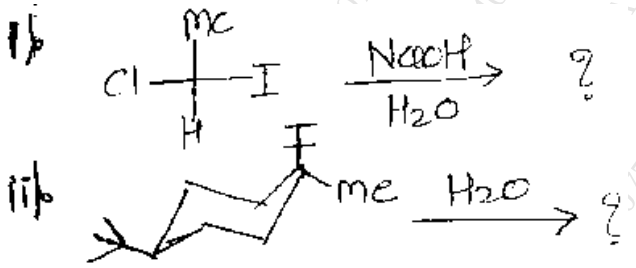
b) Explain with suitable example effect of substrate structure on nudeophilic substitution reaction.
c) Draw various confirmations of 1,4-Dimethyl cyclohexane. Comment on their optical activity and stability.

Q7 Solve the following. **12**

a) Draw various confirmations of decaline, comment or their stability.

b) Explain with suitable examples stereospecific and stereo selective reaction.

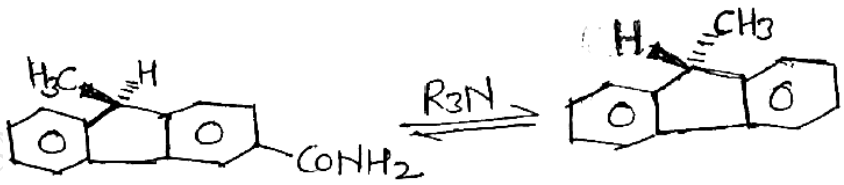
c) Predict product/ products in each of the following reactions:



Q8 Solve the following. **12**

a) Explain, why the rate of acetolysis of compound (I) is 10^{11} times faster than that of compound (II) and proceed with retention of configuration.

b) Suggest the mechanism for following organic transformation.



c) Write a note on stereochemistry of allenes.

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SUBJECT CODE NO: - FF-6502
FACULTY OF SCIENCE AND TECHNOLOGY
M.Sc. (Sem-I) (Chemistry)
Examination January-2023
Analytical Chemistry -CHE - 101

[Time: 3:00 Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N. B 1) Question1 is compulsory.
2) Solve any five questions from question number 2 to 8.

Q1 Attempt the following. 20

a. Explain in brief rate theory of chromatography.

b. Describe the methods for development of chromatogram.

c. Discuss in brief the types of error.

d. Write a short note on 'The F test'

e. A batch of nuclear fuel pellets was weighted to determine if they fell within control guidelines. The weights were 127.2; 128.4; 127.1; 129.0 and 128.1gm.

Calculate the mean and range of the set of observations.

f. Discuss the factors affecting on the column efficiency.

g. Explain the terms normal phase chromatography and reverse phase chromatography.

h. Enlist the types of detectors used in HPLC.

i. Describe the principle of liquid-liquid partition chromatography.

j. Give the applications of gas chromatography.

Q2 Attempt the following. 12

a. The precision of a method is being established, and the following data are obtained.

22.23; 22.18; 22.25; 22.09 and 22.17%

Is 22.09 a valid measurement at the 95% confidence level?

[Q_{table}: 0.710]

b. Write notes on –

i. Significant figures

ii. The confidence limit

Q3 Attempt the following. 12

a. Arsenic (III) is 70% extracted from 7m HCL into an equal volume of toluene. What percentage will remain unextracted after three individual extractions with toluene?

b. What is distribution ratio and distribution coefficient? Derive the equation showing relationship between distribution ratio and distribution coefficient.

Q4 Attempt the following. 12

a. What is zone broadening? Discuss the different factors affecting on it.

b. Write notes on

i. Selection of chromatograph system.

ii. Plate theory of chromatography

Q5 Attempt the following. 12

a. What is the principle of size exclusion chromatography? Write a note on gel preparation and column packing in gel permeation chromatography.

b. How do the stationary and mobile phases selected in the partition chromatography ?

Q6 Attempt the following. 12

a. Explain with labelled diagram instrumentation of gas chromatography.

b. What is the principle of HPLC?

Explain in detail applications of it.

Q7 Attempt the following. 12

a. i) List the proper number of significant figures in the following numbers and indicate which zeros are significant?

0.00675; 390.07; 100.0; 0.089

ii) Give the answer of the following.

Operation to the maximum number of significant figures and indicate the key number

$$\frac{0.798 \times 523}{0.0164 \times 127.45}$$

b. Explain in detail theory of phase contact method for repeated equilibrations.

Q8 Attempt the following. 12

a. Compare the gel permeation chromatography and ion-exchange chromatography.

b. Write notes on

i) HPLC adsorption and partition chromatography

ii) Quantitative utility of gas chromatography.