Registration Number:
Date & session:

ST. JOSEPH'S UNIVERSITY, BENGALURU -27
B.Sc. CHEMISTRY – II SEMESTER
SEMESTER EXAMINATION: APRIL 2023
(Examination conducted in May 2023)
CH 221: CHEMISTRY-II

(For current batch students only)

Time: 2 Hours **Max Marks: 60**

Note: This question paper contains **3 pages, 3 parts** and **20 questions**.

Answer **ALL** the parts.

PART-A

Answer any SEVEN of the following questions. **[7x2=14]**

1. List any two physical methods by which the end points for a titration of a metal with EDTA can be determined.
2. What are argentometric titrations?
3. Differentiate between sigma (σ) and pi (π) complexes.
4. Name an organic chelating agent used in gravimetric analysis and draw its structure.
5. Give any two solvents that favour S_N2 reaction.
6. Name any two methods to determine the molar mass of a solute using colligative properties.
7. Differentiate between Schottky and Frenkel defects.
8. What are the conditions under which a real gas behaves ideally?
9. Define inversion temperature. Give the expression for it in terms of van der Waals constants.

PART-B

Answer any SIX of the following questions. **[6x6=36]**

10. a) What are the requisites of a precipitate in gravimetric analysis?
b) For the distribution of an organic solute between water (c_1) and chloroform (c_2), the following results were obtained:

c_1	0.0160	0.0237
c_2	0.338	0.753

Determine the molecular state of the solute in chloroform. (3+3)

11. The data in the table below were obtained during a colorimetric determination of glucose in blood serum.

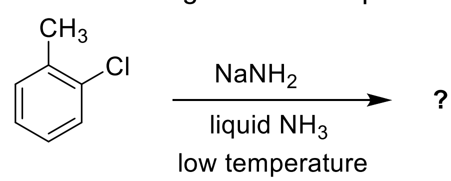
Glucose concertation, mM	Absorbance
0.0	0.002
2.0	0.150
4.0	0.294
6.0	0.434
8.0	0.570
10.0	0.704
30.0	2.154

By the least square method, calculate the slope, intercept and the equation of the least square line. What is the glucose concentration for a sample with an absorbance of 0.350? Given S_{xy} = 4.91 and S_{xx} = 70.

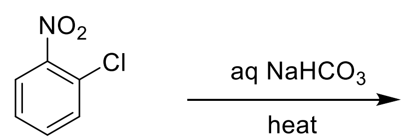
12. a) An aqueous solution containing 0.00025 Kg of a solute dissolved in 0.02 Kg of water froze at 272.58 K. Calculate the molar mass of the solute. (K_f = 1.84 K Kg mol^{-1})

    b) Explain Parkes process for desilverisation of lead using distribution law? (3+3)

13. a) Write the main product for the following reaction. Explain the mechanism.



b) Complete the following reaction with mechanism.



(3+3)

14. a) Account on the order of reactivity of the following alkyl halides for S_N1 reactions with proper reasoning:

    $CH_3CH_2CH_2CH_2Br$, $CH_3CH(CH_3)CH_2Br$, $CH_3CH_2CH(Br)CH_3$, $(CH_3)_3CBr$

    b) Explain how temperature affects the following physical properties of liquid (i) viscosity (ii) surface tension? (3+3)

15. Represent diagrammatically the unit cells for (i) a simple cubic lattice (ii) a face centered cubic lattice (iii) a body centered cubic lattice. How many atoms are present per unit cell in each of these lattices?

16. What is liquefication of a gas? Discuss Andrew's isotherm for CO_2.

17. a) Calculate the critical pressure and critical volume of a gas whose van der Waals constants are a = 0.725 L^2 atm mol^{-2}, b=0.226 L mol^{-1} (R = 8.314 J K^{-1} mol^{-1}).

    b) Among H_2O, CH_3OH, HO-H_2C-CH_2OH and HO-CH_2-CH(OH)-CH_2-OH, which is the most viscous liquid? Justify. (3+3)

PART-C

Answer any TWO of the following questions. **[2x5=10]**

18. a) 0.3605 g of Al_2O_3 was isolated gravimetrically from a 1.1105 g sample of bauxite (a primary ore of Aluminium). What is the percentage aluminium in the bauxite ore (gram atomic weight of Al = 26.98 g/mol, O =15.99 g/mol)?

b) Identify the crystal systems from the following data:

(i) $a = 4.2$ Å, $b = 4.2$ Å, $c= 3.8$ Å; $\alpha = \beta = \gamma = 90^{\circ}$

(ii) $a = 6.1$Å, $b = 7.1$ Å, $c = 5.6$ Å; $\alpha = \beta = \gamma = 90^{\circ}$ (3+2)

19. a) With proper reasoning give the decreasing order of rate of the given reaction with the following nucleophiles: CH_3O^- , AcO^-, HO^-, PhO^-.

$$CH_3Br + Nu^- \longrightarrow CH_3Nu + Br^-$$

species	**pK_a in ethanol**
Phenol	10
Acetic acid	4.8
Water	15.7
Methanol	15.5

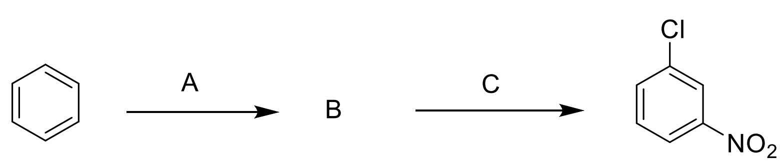
b) Write down the increasing order of rate of the following hydrolysis reaction when various methyl halides are treated with sodium hydroxide. Explain your answer.

$$H_3C\text{—}X \quad + \quad HO^- \longrightarrow H_3C\text{—}OH \quad + \quad X^-$$

X = F, Cl, Br, I

(3+2)

20. a) Identify A, B and C in the following reaction sequence:



b) Calculate the interplanar distance for (100) planes in a metal lattice with a length of 425 pm. (3+2)