

Register No:

Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

B.SC. CHEMISTRY: II SEMESTER

SEMESTER EXAMINATION – APRIL 2022

(Examination conducted in July 2022)

CH221: CHEMISTRY-II

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. In the analysis of 0.7011 g of an impure chloride-containing sample, 0.9805 g of AgCl was precipitated. What is the percentage by mass of chloride in the sample? (atomic mass of Ag = 107.86 g mol⁻¹, Cl = 35.45 g mol⁻¹).
2. Name any two figures of merit in an analytical procedure.
3. Define the term collision number.
4. Write the general rate expression for an aromatic nucleophilic substitution reaction.
5. Define compressibility factor. What is the compressibility factor for an ideal gas?
6. Multidentate ligands are chosen as titrants for complexometric titrations. Give reasons.
7. Explain the term anisotropy in crystalline solids with an example.
8. What is co-precipitation?
9. A solution containing 2.44 g of a solute dissolved in 75 g of water boiled at 100.34 °C. Calculate the molar mass of the solute (K_b for water = 0.52 K kg mol⁻¹).

PART-B

Answer any SIX of the following questions.

[6x6=36]

10. Explain Andrew's P-V isotherm for CO₂ and mention the critical parameters in the P-V isotherm.
11. Explain the mechanism and kinetics of an S_N2 reaction. Give the energy profile diagram of this reaction.
12. a) How does benzene react with fuming sulphuric acid? Discuss the mechanism of this reaction.
b) What is axis of rotation? Draw the 2-fold axis of rotation in a cubic unit cell.
(3+3)
13. Using the resonance stabilization of arenium ions, explain the orienting effect of –CH₃ group in toluene towards further electrophilic substitution reaction.
14. a) Explain how the following factors affect viscosity:
(i) intermolecular forces and, (ii) temperature.

b) Applying distribution law, derive an expression to calculate the amount of solute left unextracted in a given number of operations. (3+3)

15. The sulphate ion concentration in natural water can be determined by measuring the turbidity that results when an excess of BaCl_2 is added to a measured quantity of the sample. A turbidimeter, the instrument used for this analysis, was calibrated with a series of standard Na_2SO_4 solutions. The following data were obtained in the calibration for sulphate concentrations, (cx):

cx, mg $\text{SO}_4^{2-}/\text{L}$	Turbidimeter Reading, R
0.0	0.06
5.0	1.48
10.0	2.28
15.0	3.98
20.0	4.61

Assuming there is a linear relationship between the instrument reading and concentration of sulphate, compute the slope, intercept and least square equation from the data. Given: $S_{xx}=250$, $S_{yy}= 13.68$, and $S_{xy} =57.5$.

16. a) How is the Nernst distribution law modified when the solute undergoes association in one of the solvents?

b) List three advantages of organic reagents over inorganic reagents in gravimetry? (3+3)

17. a) List the titration methods involving EDTA and describe one of them.

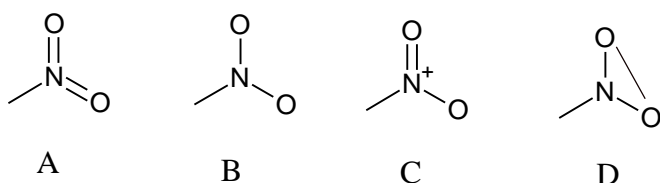
b) What are the conditions necessary to determine the total hardness of water by EDTA method? (3+3)

PART-C

Answer any TWO of the following questions.

[2x5=10]

18. The nitro group can be written in different forms as depicted below. The experimental value of Parachor for NO_2 group is 74. Identify and explain the correct structure from among the following:



19. a) Identify the crystal systems from the following data.

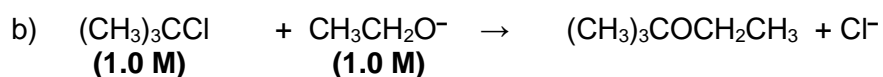
(i) $a = 7.9 \times 10^{-7} \text{ m}$, $b = 4.0 \times 10^{-7} \text{ m}$, $c = 5.5 \times 10^{-7} \text{ m}$; $\alpha = \gamma = 90^\circ$, $\beta = 105^\circ$.

(ii) $a = b = c = 6.2 \times 10^{-7} \text{ m}$; $\alpha = \beta = \gamma \neq 90^\circ$.

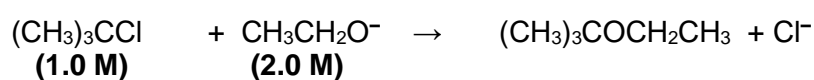
b) (i) A cubic unit cell has the following Miller indices: (202), (002), (211), (310), (330) and (222). Identify the lattice type. Give reasons.

(ii) Calculate the separation of the (112) planes in a cubic crystal with the unit cell side 562 pm. (2+3)

20. For S_N1 reactions, which of the reactants in each pair will react more rapidly and why?



OR



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