

RAMAKRISHNA MISSION VIDYAMANDIRA
(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2025

FIRST YEAR (BATCH 2024-28)

INDUSTRIAL CHEMISTRY

Paper : 2INCCOC1

Date : 17/05/2025

Time : 11.00 am – 1.00 pm

Full Marks : 50

[Use **one** Answer Book for **Unit - I & II** and **another** Answer Book for **Unit - III**]

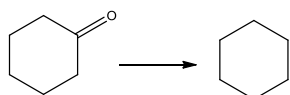
Unit-I

Answer **any four** questions :

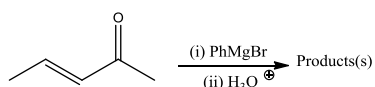
[4×5]

1. a) Do the conversion with the proper mechanism.

[3]



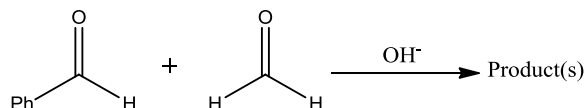
b) Find the product(s) of the following reaction.



[2]

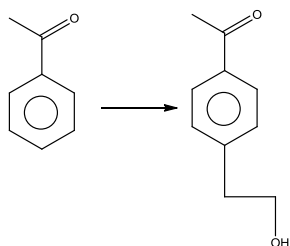
2. a) Predict the product(s) with proper mechanism.

[3]



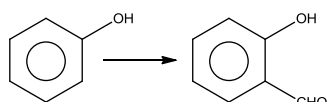
b) Carry out the following transformation with suitable reagent.

[2]



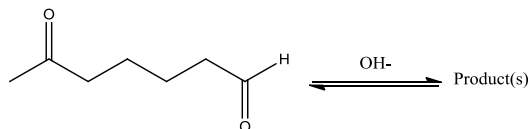
3. a) Carry out the following transformation with suitable mechanism.

[3]

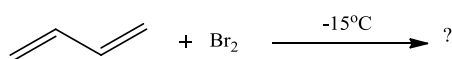


b) Find the product(s).

[2]



4. a) Find the product(s).



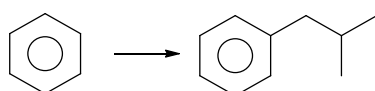
[2]

b) What is the Bayer angle Strain?

[1]

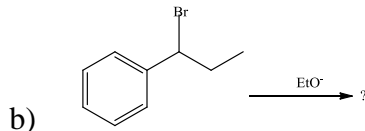
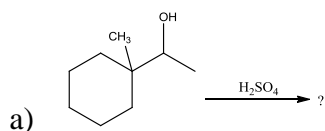
c) Carry out the following conversion with proper mechanism.

[2]

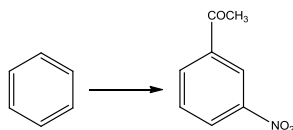


5. Identify the product and write the reaction mechanics of the following reactions: -

[5]



6. a) Carry out the following transformation with suitable mechanism.



b) How will you obtain a single product in a cross-aldol condensation reaction? Mention any one suitable method.

[3+2]

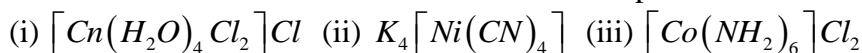
Unit-II

Answer **any three** questions:

[3×5]

7. a) Red precipitate is obtained when ethanolic solution of dimethyl-glyoxime is added to ammoniacal Ni(II). - Explain with reaction.

b) Write the IUPAC name of the co-ordination compounds -



[2+3]

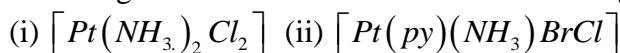
8. a) Give evidence to support Werner's theory of co-ordination compounds.

b) What is masking and damasking agents in analytical chemistry?

[3+2]

9. a) Explain factors affecting complex stability.

b) Discuss geometrical isomerism for the following co-ordination compounds -



[2+3]

10. a) Explain how pH of water can be changed with the temperature.

b) 1 L of 0.4 (M) NH_4OH is mixed with 1 L of 0.4 (M) HCl . What is the pH of the solution? [$K_b = 2 \times 10^{-5}$ for NH_4OH].

[2+3]

11. a) Balance the reaction: $MnO_4^- + Fe^{2+} + H^+ \rightarrow Fe^{3+} + Mn^{2+}$

b) Calculate the half-cell potential of above equation.

[2+3]

Unit-III

Answer **any three** questions :

[3×5]

12. a) What is fluorescence? Describe its mechanism using a Jablonski diagram.

b) Why phosphorescence is a much delayed radiation with respect to fluorescence?

[3+2]

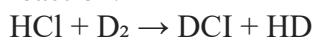
13. a) Write the expression for vibrational energy levels of a harmonic oscillator. What are overtones?

b) What are the normal mode of vibration of H_2O ? Depict with suitable pictures and also explain the reason of IR activity/inactivity of these normal modes.

[2+3]

14. Determine the ratio of population in $J'=2$ and $J''=1$ states for $^{12}C^{16}O$ at room temperature given that the rotational constant for the molecule is 1.923 cm^{-1} (Given, $K_B = 1.381 \times 10^{-23} \text{ joule per kelvin (K)}$). [5]

15. The vibrational wavenumbers of the following molecules in their $v=0$ states are: HCl : 2885 cm^{-1} ; DCl : 1990 cm^{-1} ; D_2 : 2990 cm^{-1} ; and HD : 3627 cm^{-1} . Calculate the energy change, in kJ/mol of the reaction:



and determine whether energy is liberated or absorbed.

[5]

16. If the rotational constant for $H^{35}Cl$ is 10.59 cm^{-1} . Calculate the value of rotational constant for $^2D^{35}Cl$?

use mass of $^{35}Cl = 58.06 \times 10^{-27} \text{ kg}$

mass of $^2D = 3.344 \times 10^{-27} \text{ kg}$

mass of $^1H = 1.673 \times 10^{-27} \text{ kg}$

[5]

————— × —————