

U.G. 4th Semester Examination - 2024

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-9

(Inorganic)

Full Marks : 40

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

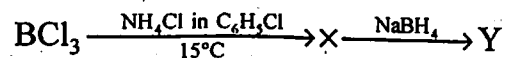
1. Answer any five questions:

 $2 \times 5 = 10$

- What is magic number? Write its significance.
- How many α and β particles are emitted in the decay process of $^{238}\text{U}_{92}$ to $^{206}\text{Pb}_{82}$?
- What are the decay modes of $^{14}\text{C}_6$ and $^{13}\text{N}_7$ radionuclei?
- Give example of coordination isomerism mentioning its IUPAC name.
- 'Square-planar complexes can be optically active.' Justify if the statement is true.
- What is the STYX number of B_2H_6 ? Explain.

[Turn Over]

g) Identify X and Y in –



h) What is 'hypo?' How is it used to fix photographs?

2. Answer any two questions: $5 \times 2 = 10$

a) i) Define half-life and mean-life of a radionuclei. How they are related?

ii) A small amount of solution containing ^{24}Na ($t_{1/2} = 15$ hours) with initial activity of $2 \times 10^3 \text{ s}^{-1}$ is injected into bloodstream of a man. The activity of 1 cc of blood was found to be 16 min^{-1} after 5 hours. Calculate the blood volume of the man.

2+3

b) i) What is artificial radioactivity? Give example.

ii) Describe nuclear fission and fusion reactions with examples.

iii) What types of fuels, moderators and coolants are used in nuclear reactors?

1+2+2

c) i) Draw structures of one tri- and tetradentate chelating ligands.

ii) The pK_a values of $\text{H}_6\text{EDTA}^{2+}$ are 0.0, 1.5, 2.0, 2.69, 6.13 and 10.37. Draw the zwitterionic structures of EDTA that exist in $\text{pH} < 5$.

iii) Explain why chelate effect is optimum only for 5- or 6-member ring complexes?

1+2+2

d) Write short notes on (any two): $2 \times \frac{1}{2} + 2 \times \frac{1}{2}$

i) Inorganic benzene

ii) Raschig's process

iii) Chlorofluorocarbons

iv) Interhalogen compounds

3. Answer any two questions: $10 \times 2 = 20$

a) i) What is radioactive equilibrium?

ii) What is the nuclear stability zone? Draw the Segrè chart (plot of N vs. Z).

iii) Discuss the processes with examples by which nuclides situated outside of the stability zone may approach the zone.

2+3+5

b) i) What is the minimum and sufficient symmetry condition for a complex to be optically active?

- ii) Draw the *fac* and *mer* isomers of $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ and explain why they are not optically active?
- iii) How many geometrical isomers of $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$ exist and state which isomer(s) might display optical activity?
- iv) Using Bailar's method draw the isomers of the complex $\text{Ma}_2\text{b}_2\text{c}_2$ (a, b and c are monodentate ligands) and identify which are the chiral isomers. 2+2+2+4
- c) i) Discuss three properties of Li that resembles to Mg.
- ii) What is Goldschmidt's thermit process?
- iii) What happens when alkali metals are dissolved in liquid NH_3 ? 4+3+3
- d) i) Discuss the structures of three types of carboranes.
- ii) Discuss the structures of the oxy-acids of phosphorous.
- iii) Discuss the structures of silicates. 3+4+3
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