

Name of the Examination **FIVE YEAR INTEGRATED M. Sc.**

Part/Semester **V**

2021

Subject **CHEMISTRY THEORY**

Paper/Course **CH-3-5-2**

Half

Time **Four (04) Hours**

Full Marks **80**

Questions are of value as indicated in the margin

Group-A

(Answer any ten Questions)

- 1 (a) Express proton and neutron in the light of Quarks. 10 x 2
(b) Calculate spin and parity of Fe-57.
(c) What are nuclear isomer and nuclear spin isomer?
(d) Calculate the radioactivity of 1 gram Ra-226 ($t_{1/2} = 1600$ year).
(e) What are the different carbenes and among them which one is more stable?
(f) Give an example of substrate which gives intramolecular aldol condensation.
(g) Write a reaction which involves the carbene intermediate. How this is generated?
(h) Which type of solvent is suitable for E_2 mechanism and Why?
(i) Define transport number.
(j) The specific conductivity of CH_3COOH increases with dilution. Explain why?
(k) State the Kohlrausch law.
(l) The observed conductance of an electrolytic solution at room temperature is $\kappa \text{ ohms}^{-1}$, when measured with a conductivity cell of cell constant unity. Write down the expression of molar conductance of the electrolytic solution having concentration " c " mol.lit^{-1} .

Group-B

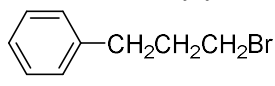
(Answer any two Questions)

2. (a) Draw the neutron versus proton curve of the nuclides and discuss what happens when (i) 5 + 5
neutron/proton ratio is too high and (ii) neutron/proton ratio is too low.
(b) Describe nuclear shell model and mention its utility.
3. (a) Derive an expression for nuclear size based on Rutherford's alpha scattering experiment. 5 + 5
Find out the nuclear density and interpret the result.
(b) Mention the characteristics of nuclear force and explain its origin in the light of pi meson theory.
4. (a) What is nuclear potential? Draw nuclear potential well for proton and neutron. Write 5 + 5
nuclear configuration of As-76.
(b) What do you mean by radioactive equilibrium? Differentiate between the Secular and transient equilibriums.

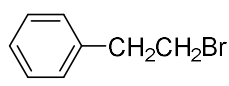
Group-C

(Answer any two Questions)

5. (a) Which of the following compound is a good substrate for E_{1cb} mechanism for elimination reaction using a suitable base? Justify your answer. What about the other one and why? 2+2

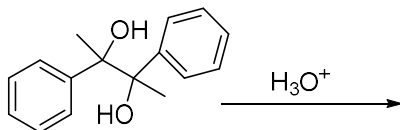
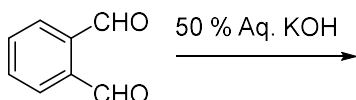


I

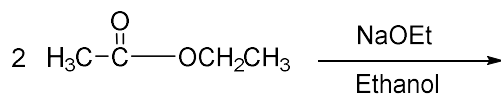
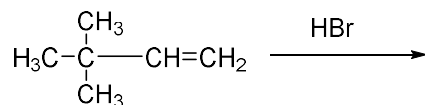


II

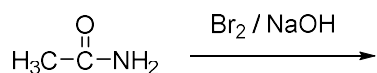
- (b) Predict the product(s) with proper reaction mechanism for the following reactions. 3+3



6. (a) Explain stereochemical outcome with proper mechanistic path for the addition reaction of bromine with trans-but-2-ene in anti-fashion. 4
- (b) Predict the product(s) with possible reaction mechanism for the following reactions. 3+3



7. (a) What is cross over experiment? Explain briefly the outcome of this experiment. 4
- (b) Why bromine and sodium hydroxide is essential for Hofmann rearrangement to primary amine? Predict the product with proper reaction pathway for the following reaction. 3



- (c) What is the similarity of Curtius reaction with Hofmann rearrangement? Explain mechanistically. 3

Group-D

(Answer any two Questions)

8. (a) Write the differences between a galvanic cell and an electrolytic cell? What are the differences between electronic conductors and electrolytic conductors? 2+2
- (b) Define specific conductivity of an electrolytic solution and mention its dimension in SI unit. What is Cell constant of a conductometric bridge? How can we measure it in the laboratory? 2+1+2
- (c) The equivalent ionic conductance at infinite dilution of Ba^{++} and Cl^{-} ions is 63.64 and 1

76.34 $\text{ohm}^{-1}\text{cm}^2\text{equiv}^{-1}$, respectively. Calculate the molar conductance of BaCl_2 at infinite dilution.

9. (a) Define the Walden rule. 2
- (b) What are the electrophoretic effect and relaxation effect? How are they related to the ionic conductance of an electrolyte? 2+2
- (c) The equivalent conductance of HCl at infinite dilution is $426.16 \text{ ohm}^{-1}\text{cm}^2\text{equiv}^{-1}$ and the transport number of H^+ ion (t_+) is 0.821. Calculate ionic conductance of H^+ ion and Cl^- ion at infinite dilution. 4
- 10 (a) Write the relationship between molar conductance and equivalent conductance. 1
- (b) What is mobility of an ion in the electrolytic solution? How it is related to the transport number of the ion? 2
- (c) At 18°C the specific conductivity of a saturated solution of AgCl is $1.19 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$ and that of pure water at the same temperature is $0.40 \times 10^{-7} \text{ ohm}^{-1}\text{cm}^{-1}$. If the equivalent conductance of Ag^+ ions and Cl^- ions at this temperature are 53.8 and $65.9 \text{ ohm}^{-1}\text{cm}^2\text{equiv}^{-1}$, respectively, calculate the solubility product of AgCl . 4
- (d) Draw and explain the conductometric titration curve of a strong acid (HCl) by a weak base (NH_4OH). 3