

2m/CHE-150 (Th) Syllabus-2023

2026

(May-June)

FYUP : 2nd Semester Examination

CHEMISTRY

(Minor)

Part—A (Theory)

(Introductory Chemistry—II)

(CHE-150)

Marks : 56

Time : 3 hours

*The figures in the margin indicate full marks
for the questions.*

UNIT—I

(Inorganic Chemistry—II)

(Marks : 19)

1. (a) Half-life period of $^{125}_{53}\text{I}$ is 60 days. What percentage of the original radioactivity would be present after 180 days? 2
- (b) What is nuclear fission? Give example. 1

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(Turn Over)

- (c) Write the differences between the chemical reactions and nuclear reactions. 2
- (d) Balance the following reaction by ion-electron method : 2
- $$\text{Cr}_2\text{O}_7^{2-} + \text{I}^- \xrightarrow{\text{(acidic medium)}} \text{Cr}^{3+} + \text{I}_2$$
- (e) Calculate the equivalent weight of KMnO_4 in acidic medium. (Molecular weight of $\text{KMnO}_4 = 158.034 \text{ g/mol}$) . 1
- (f) Find the oxidation number of Cr in K_2CrO_4 and $\text{Cr}_2(\text{SO}_4)_3$. 1

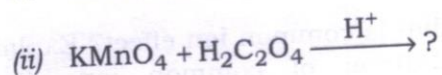
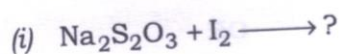
OR

2. (a) Define mass defect and binding energy. Calculate the binding energy of oxygen atom $^{16}_8\text{O}$ which has a mass of 15.99491 amu. Given that mass of neutron = 1.00893 amu, mass of proton = 1.007825 amu and mass of electron = 0.0005486 amu. 2
- (b) Write the relation between average life period and half-life period for the disintegration of a radioactive substance. 1
- (c) How does nuclear stability vary with binding energies of nuclei? 2

(3)

(d) Define the electronic concept of oxidising and reducing agents. Give example. 2

(e) Complete and balance the following redox reaction by ion-electron method : 2



3. (a) Define solubility product. How is the concept of solubility product used in the group separation of cations that belongs to group I? 2

(b) Mention the basic requirements for a solution to be termed as primary standard solution. Give one example of primary standard solution. 1½

(c) 25 ml of iodine solution required 24.85 ml of 0.2 M solution of hypo, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ for complete titration. Calculate the molarity of iodine solution. 1½

(d) "All Arrhenius acids are also Bronsted acids, but all Arrhenius bases are not Bronsted bases." Explain. 1

(4)

- (e) Discuss the behaviour of H_2O as an amphoprotic substance. 1
- (f) Explain the phenomenon of levelling and differentiating effect using a suitable solvent. 3

OR

4. (a) What is common ion effect? Explain the condition of common ion effect in group II of systematic group separation of cations. 1+1=2
- (b) What is permanganometry? Give an example which acid is used in permanganometry. Why? 2
- (c) Define normality with an example. 1
- (d) Write the conjugate base for the following acids : 1
- $\text{H}_2\text{SO}_4, \text{H}_3\text{O}^+$
- (e) Using solvent system concept, explain the following observation : 2
- "Ammonium chloride acts as an acid while potassium amide acts as a base in liquid NH_3 ."
- (f) What is symbiosis? Give example. 2

(5)

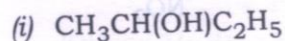
UNIT—II

(Organic Chemistry—II)

(Marks : 18)

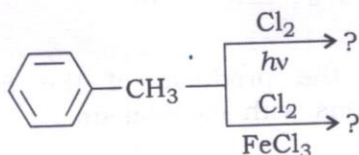
5. (a) What are the conditions for a molecule to be optically active? 2

(b) Indicate the types of stereoisomerism exhibited by the following molecules. Draw the isomers of each : 2



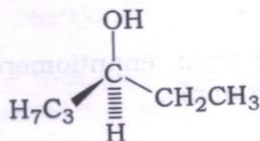
(ii) 2-Chloro-2-methylpent-2-ene

(c) Complete the following reactions : 2



(d) The —OH group attached to a benzene ring is ortho- and para-directing towards electrophilic substitution reactions, but —NO₂ group is meta-directing. Explain. 2

(e) Assign R/S configuration

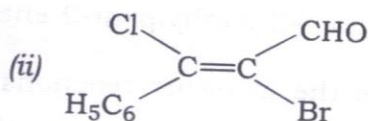
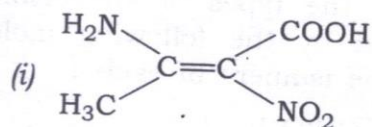


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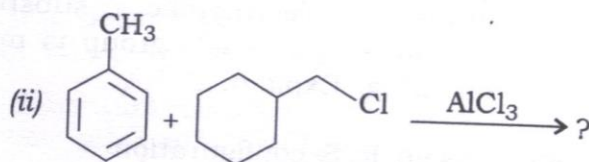
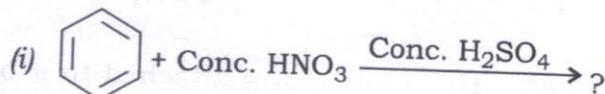
OR

6. (a) Draw the different conformers of ethane. Which conformer is most stable and why? 2

- (b) Assign *E/Z* configuration to the following molecules : 2



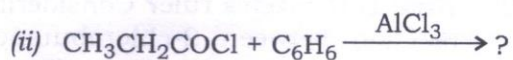
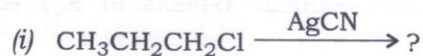
- (c) Write the products of the following reactions with mechanism : $2 \times 2 = 4$



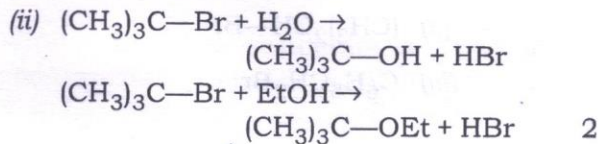
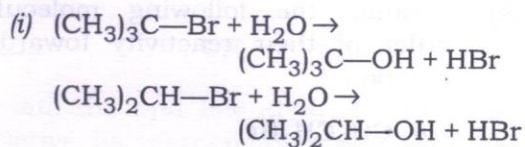
- (d) Define the term 'enantiomers' citing a suitable example. 1

(7)

7. (a) Complete the following reactions : 2



(b) Which $\text{S}_{\text{N}}1$ reaction of each pair is expected to take place at a faster rate and why?



(c) Highlight the differences between $\text{E}1$ and $\text{E}2$ reactions. 3

(d) Explain the effect of solvent on the rate of $\text{S}_{\text{N}}1$ reaction. 2

OR

8. (a) How does the strength of a nucleophile affect the rate of nucleophilic substitution reaction? 2

(b) Prove that an $-\text{OH}$ (phenolic) group is an activating group. Give example. 1

- (c) Explain with a suitable example, the stereochemical aspects of S_N1 reaction. 2
- (d) What is Saytzeff's rule? Considering the reaction between 2-chlorobutane and alcoholic KOH, apply Saytzeff's rule to justify the formation of the major and minor products. 1+2=3
- (e) Arrange the following molecules in order of their reactivity towards S_N1 reaction : 1
- (i) CH_3CH_2Br
 - (ii) $(CH_3)_2CH-Br$
 - (iii) $C_6H_5CH_2Br$

UNIT—III

(Physical Chemistry—II)

(Marks : 19)

9. (a) Define the following terms : 1+1=2
- (i) Adiabatic process
 - (ii) Isothermal process
- (b) Deduce a relation between C_p and C_v 2

(9)

- (c) One mole of an ideal gas undergoes reversible isothermal expansion from an initial volume of V_1 to a final volume of $10 V_1$ and does 10 kJ of work. The initial pressure was 1×10^7 Pa. Calculate V_1 . (Given $R = 8.314 \text{ m}^3 \text{ Pa K}^{-1} \text{ mol}^{-1}$) 3
- (d) What are the limitations of the first law of thermodynamics? State second law of thermodynamics. 2+1=3

OR

10. (a) State the first law of thermodynamics. Derive its mathematical equation. 1+2=3
- (b) What do you understand by a spontaneous process? Explain with a suitable example. 1+1=2
- (c) Define the following terms : 1×2=2
- (i) Extensive properties
- (ii) State variables
- (d) Calculate ΔE , q and w if 2 moles of hydrogen at 3 atm pressure expand isothermally at 323 K and reversibly to a pressure of 1 atm. 3
11. (a) Explain the difference between endothermic reactions and exothermic reactions with the help of a graph. $1\frac{1}{2}+1\frac{1}{2}=3$

(10)

- (b) Derive Kirchhoff's equation in terms of ΔH of a reaction. 2
- (c) State with reasons whether the following statements are true or false : $1\frac{1}{2} + 1\frac{1}{2} = 3$
- (i) Physisorption is a fast process.
- (ii) Chemisorption does not go beyond monolayer formation.
- (d) What do you mean by an adsorption isotherm? 1

OR

12. (a) Define the following terms : $1 \times 2 = 2$
- (i) Enthalpy of solution
- (ii) Hess' law of constant heat summation
- (b) The enthalpies of combustion of benzene, carbon and hydrogen are -3267.7 kJ, -393.5 kJ and -286.2 kJ respectively. Calculate the enthalpy of formation of benzene. 3
- (c) Describe Langmuir adsorption theory and derive the equation for adsorption. $1 + 3 = 4$
