

**2M/CHE-150(Th) Syllabus-2023**

**2026**

**( May-June )**

**FYUP : 2nd Semester Examination**

**CHEMISTRY**

**( Major )**

**Part—A**

**( Introductory Chemistry—II )**

**( CHE-150 )**

**( Theory )**

**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) Define group displacement law.  
Differentiate between nuclear reaction  
and chemical reaction. 1+2=3

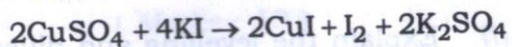
- (b) Calculate the binding energy per nucleon in  $^{35}_{17}\text{Cl}$  nucleus. Given that mass of neutron = 1.00893 a.m.u., mass of proton = 1.007825 a.m.u., mass of  $^{35}_{17}\text{Cl}$  = 34.980 a.m.u., 1 a.m.u. = 931 MeV. 2
- (c) Evaluate equivalent weight of  $\text{KMnO}_4$  for its reduction reaction in acidic and basic solutions. (Given Molecular weight of  $\text{KMnO}_4$  = 158.034 g/mol) 2
- (d) Complete and balance the following equation by ion-electron method : 1
- $$\text{K}_2\text{Cr}_2\text{O}_7 + \text{FeSO}_4 \xrightarrow{\text{H}^+} ?$$
- (e) Find oxidation number of (i) Cu in  $\text{CuSO}_4$  and (ii) C in  $\text{H}_2\text{C}_2\text{O}_4$ . 1

OR

2. (a) Derive the first-order rate equation of a radioactive disintegration. 2
- (b) How does a nuclear stability attain when the  $n/p$  ratio is too high? 2
- (c) Write the relation between average life period and half-life period for the disintegration of a radioactive substance. 1

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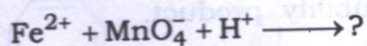
- (d) Identify the oxidant and reductant in the following reactions. Calculate the equivalent weight of oxidant : 2



(Molecular weight of  $\text{CuSO}_4$   
= 159.61 g/mol)

Molecular weight of KI  
= 166.0028 g/mol)

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



3. (a) What are the basic requirements for a solution to be termed as primary and secondary standard solution? Give examples for each. 2

- (b) " $\text{H}_2\text{S}$  is used as group reagent in group II and group IIIB in the analysis of cations in systematic group separation." Why are Group IIIB cations not precipitated in Group II, all precipitates being in the form of their sulphides? 1

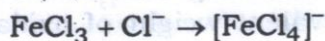
- (c) Distinguish between iodometry and iodimetry. Write one redox reaction showing iodometric method. 2

- (d) Give the conjugate acids of  $\text{H}_2\text{O}$  and  $\text{NH}_3$ . 1

( 4 )

- (e) Identify Lewis acid and Lewis base in the following reaction :

1



- (f) Explain the levelling and differentiating effect of acids and bases with appropriate examples.

3

OR

4. (a) The solubility of  $\text{CaF}_2$  in water at  $18^\circ\text{C}$  is  $2.05 \times 10^{-4}$  mol/litre. Calculate its solubility product.

1

- (b) Explain Arrhenius concept of acids and bases. What are its limitations?

2

- (c) What is SHAB principle?

1

- (d) 20 ml of 0.001 M  $\text{AgNO}_3$  solution is added to 100 ml of 0.002 M  $\text{K}_2\text{CrO}_4$  solution. Will there be any precipitation? ( $K_{\text{sp}}$  of  $\text{Ag}_2\text{CrO}_4$  is  $2.4 \times 10^{-12}$ )

2

- (e) What is permanganometry? Give example. Which acid is used in permanganometry and why?

2

- (f) How are  $\text{p}K_{\text{a}}$  and  $\text{p}K_{\text{b}}$  values related to strength of acids and bases? Among  $\text{H}_3\text{PO}_4$ ,  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{2-}$ , which one is expected to have the lowest value of  $\text{p}K_{\text{a}}$ ?

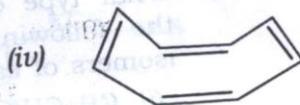
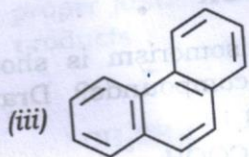
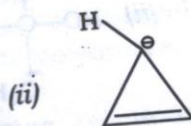
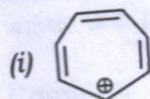
1+1=2

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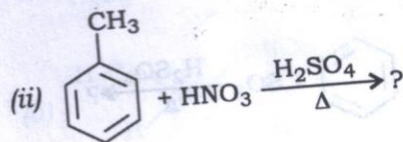
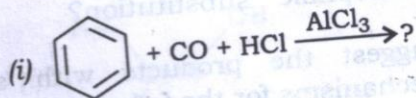
**UNIT—II**  
**( Organic Chemistry—II )**

( Marks : 18 )

5. (a) Draw all the possible conformers of *n*-butane. Sketch the energy diagram and from it deduce the stable conformers. 2
- (b) Which of the following species exhibit aromatic character? 2



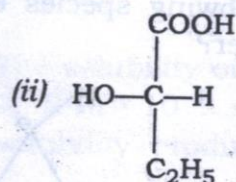
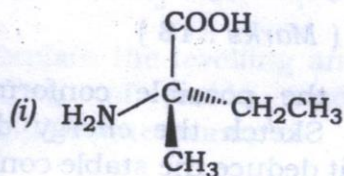
- (c) Write the products of the following reactions with appropriate mechanisms:  $1\frac{1}{2} \times 2 = 3$



( Turn Over )

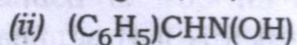
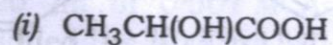
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- (d) Assign *R/S* configuration to the following molecules : 2



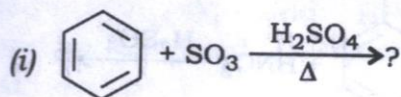
OR

6. (a) What type of isomerism is shown by the following compounds? Draw the isomers of each : 2

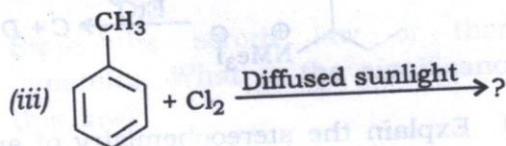
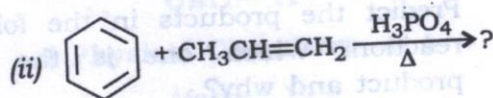


- (b) Why does benzene undergo electrophilic substitution more readily than nucleophilic substitution? 1

- (c) Suggest the products with suitable mechanisms for the following reactions :  $1\frac{1}{2} \times 3 = 4\frac{1}{2}$

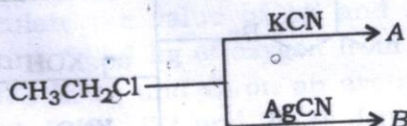


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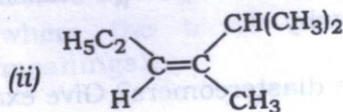
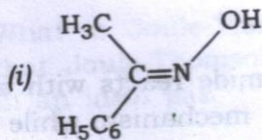


(d) A compound  $\text{C}_4\text{H}_{10}\text{O}$  shows optical activity. Identify the compound and write the possible stereoisomers. 1½

7. (a) Complete the following reactions with proper justification for the formation of products : 1+1+1=3



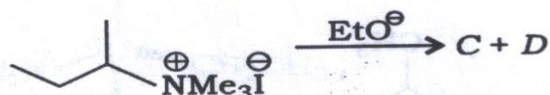
(b) Assign *E/Z* configuration to the following molecules : 1



( 8 )

- (c) Predict the products in the following reaction. Which one is the major product and why?

3



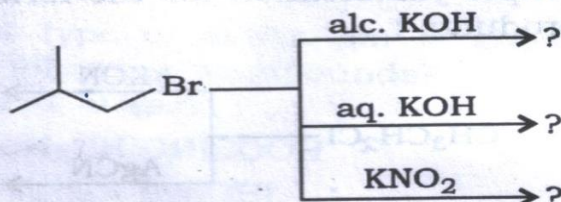
- (d) Explain the stereochemistry of an  $\text{S}_{\text{N}}2$  reaction by giving a suitable example.

2

OR

8. (a) Write the products of the following reactions :

3



- (b) Explain the stereospecific nature of  $\text{E}2$  reaction by giving a suitable example.

2

- (c) *tert*-butyl bromide reacts with aqueous NaOH by  $\text{S}_{\text{N}}1$  mechanism while *n*-butyl bromide reacts by  $\text{S}_{\text{N}}2$  mechanism. Explain why.

3

- (d) What are diastereomers? Give example.

1

( 9 )

UNIT—III

( Physical Chemistry—II )

( Marks : 19 )

9. (a) State the zeroth law of thermodynamics. What is the significance of this law? 1+1=2
- (b) Derive an expression for the work done in isothermal reversible expansion of an ideal gas. 3
- (c) Define the following terms : 1+1=2
- (i) Molar heat capacity
- (ii) Inversion temperature
- (d) Calculate the value of  $\Delta E$  and  $\Delta H$  on heating 0.064 kg of oxygen from 273 K to 373 K.  $C_V$  and  $C_P$  on an average are  $20.93 \text{ J mol}^{-1} \text{ K}^{-1}$  and  $29.31 \text{ J mol}^{-1} \text{ K}^{-1}$  respectively. 3

OR

10. (a) What is Joule-Thomson effect? Show that Joule-Thomson coefficient is zero in an ideal gas. 1+2=3
- (b) Derive the relationship  $\Delta H = \Delta E + \Delta nRT$ , where the terms have their usual meanings. 2

- (c) Write the mathematical expressions for Gibbs' adsorption isotherm and Langmuir adsorption isotherm. Explain the term involved.  $1\frac{1}{2}+1\frac{1}{2}=3$
- (d) Why does adsorption take place only at the interface? 1

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