2025

(Nov–Dec)

FYUP : 5th Semester Examination

MAJOR

CHEMISTRY

(Organic Chemistry—II)

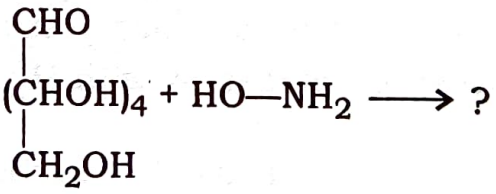
CHE-301

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Complete the following reactions by writing suitable mechanism for each : 3×2=6

(i) 

(ii) Fructose + Ph—NH—NH_2 ⟶ ?

(b) Why is maltose a reducing sugar? Explain by writing a suitable chemical reaction. 1+2=3

(c) What is epimerization? Write the steps involved in the conversion of an aldopentose to an aldohexose. 1+3=4

(d) Although cellulose contains several hydroxy groups, yet it remains insoluble in water. Explain. 2

(e) Write the products of the reaction of sucrose with *(i)* Ac_2O and *(ii)* H_2O/H^+. 1½+1½=3

OR

2. (a) What are aldoses and ketoses? Give one example of each. 1+1+1=3

(b) Why is the β-isomer of glucose more stable than the α-isomer? Explain by drawing their conformational structures. 3

(c) How will you confirm the presence of a six-membered pyranose structure in glucose by oxidation with HIO_4? 3

(d) Show by chemical reactions that glucose contains *(i)* one primary alcoholic group and *(ii)* five hydroxyl groups. 2+2=4

(e) Draw the Haworth projection formulae of *(i)* α-maltose and *(ii)* β-fructose. 2+1=3

(Continued)

(f) Write the preparation of cellulose trinitrate from cellulose. 2

3. (a) Write a chemical method of synthesis of vitamin A from β-ionone. 4

(b) What is a zwitterion? Draw the zwitterionic structures of alanine and aspartic acid. 1+1+1=3

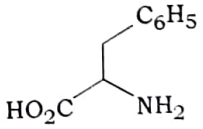
(c) Write the steps involved in the synthesis of a tripeptide gly-ala-phe and also indicate the peptide bonds in the molecule. 4+1=5

(d) What is denaturation of proteins? Explain any two factors that cause denaturation of proteins. 1+1+1=3

(e) On the basis of molecular shape, how will you differentiate between fibrous proteins and globular proteins. Give two examples of each. 2+1+1=4

OR

4. (a) How will you prepare the following amino acid by Gabriel phthalimide synthesis? 4



(Turn Over)

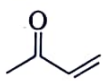
(b) Differentiate between peptides and proteins. 3

(c) Write the synthesis of ascorbic acid from D-glucose. 4

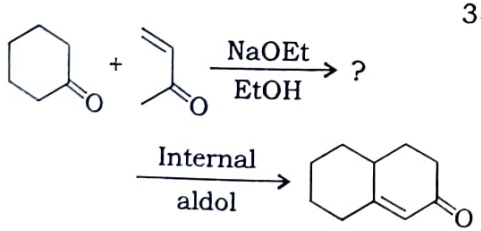
(d) What is isoelectric point of an amino acid? Show with an illustration how the amino acids exist at low and high pH. 1+1+1=3

(e) What is a primary structure of protein? Briefly explain how the β-pleated sheet structure of protein is formed. Also show how intermolecular H-bonds occur between the chains in this structure. 1+2+2=5

5. (a) What is Mannich base? Write the steps involved in the formation of the following compound by Mannich reaction : 1+3=4



(b) Complete the following reactions (any *two*) by writing suitable mechanisms : 3×2=6

(i) 

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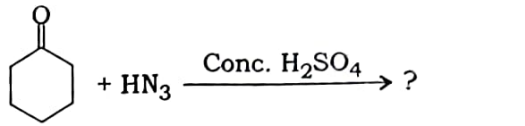
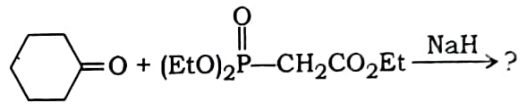
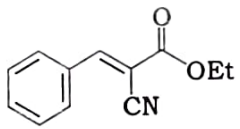
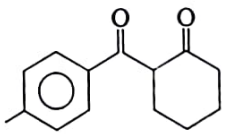
(ii) 

(iii) 

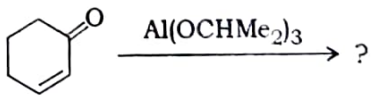
(c) How will you synthesize the following compounds? Write the relevant mechanism of each reaction : 2×2=4

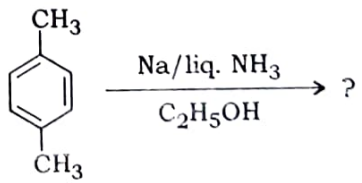
(i) 

(ii) 

(by Claisen reaction)

(d) Write down the products of the following reactions with suitable mechanisms : 2×2=4

(i) 

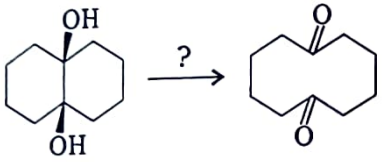
(ii) 

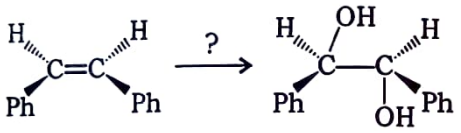
(Turn Over)

(e) Mention one advantage of $NaBH_4$ over $LiAlH_4$ as a reducing agent. 1

OR

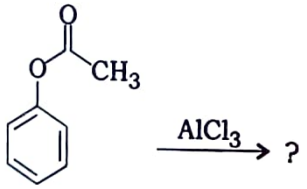
6. (a) Give the reagents used for the following transformations along with their mechanisms (any *two*) : 2½×2=5

(i) 

(ii) 

(iii) O_2N—C$_6$H$_4$—CHO $\xrightarrow{?}$ O_2N—C$_6$H$_4$—CH_2OH

(b) Discuss the effect of temperature on the following reaction :



Also write the products and mechanism of the reaction. 2+2=4

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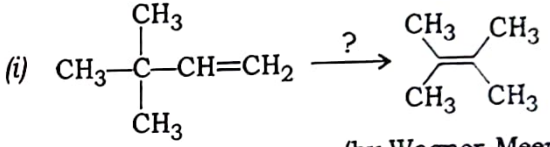
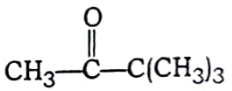
(c) How will you carry out the following transformations? Write suitable mechanisms : 2½×2=5

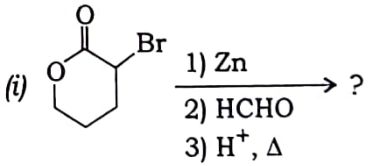
(i) 

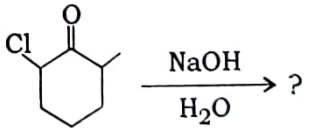
(by Wagner-Meerwein)

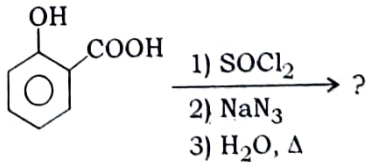
(ii) $(CH_3)_2C(OH)—C(OH)(CH_3)_2 \xrightarrow{?}$ 

(by Pinacol-Pinacolone)

(d) Complete the following reactions with mechanisms (any *two*) : 2½×2=5

(i) 

(ii) 

(iii) 

(Turn Over)

7. *(a)* Draw all the possible chair conformations of both *cis-* and *trans-*1,3-dimethyl cyclohexane. Arrange their relative stabilities by giving proper reasons. 2+2=4

(b) Write the steps involved in the polymerization of styrene by free radical mechanism. 3

(c) Write the structures of the following polymers : 1×4=4

(i) Dacron

(ii) Nylon-6,6

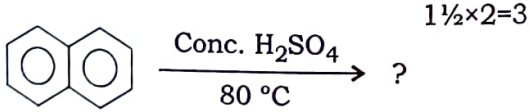
(iii) Buna-S

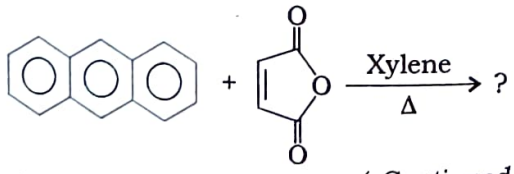
(iv) Vulcanized rubber

(d) Explain why *t*-butyl cyclohexane exist predominantly in the *trans-*conformation. 2

(e) Outline the synthesis of anthracene by Haworth synthesis. 3

(f) Write down the products along with the mechanisms for the following reactions : 1½×2=3

(i) 

(ii) 

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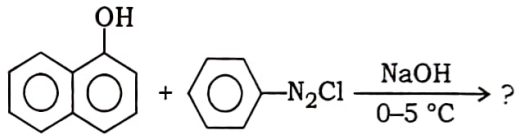
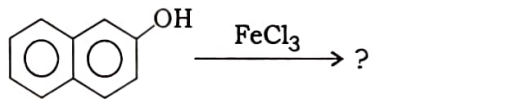
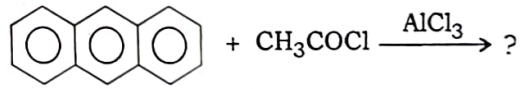
OR

8. *(a)* Electrophilic substitution reaction of naphthalene takes place exclusively at C-1. Explain with proper justification. 3

(b) Complete the following reactions : 1×3=3

(i) 

(ii) 

(ii) 

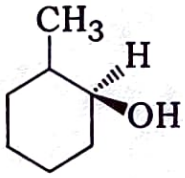
(c) Write the mechanism of polymerization of a highly stereospecific polyethylene by using $TiCl_4$–$(C_2H_5)_3Al$ catalyst. What way has this catalyst revolutionized the field of polymer chemistry? 3+1=4

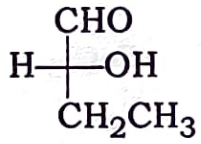
(d) Write the cyclic bromonium ion mechanism of bromine addition to *Z*-2-butene. Also explain why this mechanism leads to the formation of a racemic mixture of products. 2+2=4

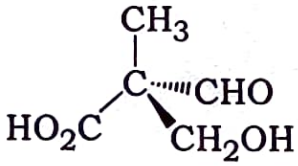
(Turn Over)

(e) How are polymers obtained by free radical mechanism different from those obtained by ionic mechanism? 2

(f) Assign *R*/*S* configurations of the following compounds : 1×3=3

(i) 

(ii) 

(iii) 

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