

Total No. of Printed Pages—15

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(November)

CHEMISTRY

(Major)

Course : 505

(Organic Chemistry)

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

(New Course)

Full Marks : 48

Pass Marks : 14

Time : 2 hours

1. Select the correct answer from the following :

1×5=5

(a) In the ground state, HOMO of 1,3-butadiene is symmetric with respect to

(i) mirror plane (m)

(ii) C_2 -axis

(iii) both mirror plane and C_2 -axis

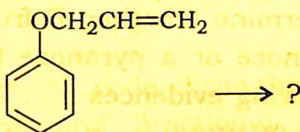
(iv) None of the above

- (b) Epimeric carbohydrates differ through their
- (i) functional group
 - (ii) ring size
 - (iii) configuration at α -C atom
 - (iv) None of the above
- (c) In the double helix of DNA, guanine of one coil involves pairing with cytosine of the other through
- (i) one H bond
 - (ii) two H bonds
 - (iii) three H bonds
 - (iv) Not through H-bond
- (d) Chloramphenicol is an example of
- (i) broad spectrum antibiotic
 - (ii) narrow spectrum antibiotic
 - (iii) polypeptide
 - (iv) lincomycin
- (e) The nature of the —OH group in the α -terpineol is
- (i) primary alcohol
 - (ii) secondary alcohol
 - (iii) tertiary alcohol
 - (iv) aryl alcohol

(3)

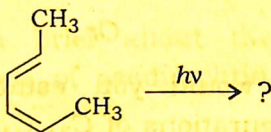
UNIT—I

2. (a) Draw the molecular orbitals of 1,3-butadiene and indicate which is HOMO and LUMO in the ground state. 2
- (b) Complete the following reaction and suggest the mechanism : 2



Or

In the following reaction, predict whether conrotatory or disrotatory motion will take place under the mentioned condition against the compound :



- (c) With the help of FMO approach, show that [4+2] cycloaddition is thermally allowed but photochemically forbidden.

$$1\frac{1}{2} + 1\frac{1}{2} = 3$$

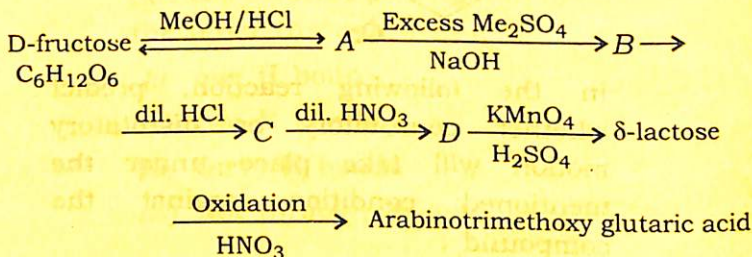
UNIT—II

3. (a) Draw the conformational structure of β -D-glucopyranose. 1
- (b) Convert D-glucose into D-fructose. 2

Or

Write in brief about the mutarotation of D-glucose.

- (c) Establish the cyclic structure of D-(+)-glucose. 3
- (d) Determine whether D-fructose is in a furanose or a pyranose form from the following evidences : 3



Or

How would you establish that the configurations of C_3 , C_4 and C_5 atoms of D-glucose and D-mannose are the same?

- (e) D-glucose reacts with HCN but not with NaHSO_3 . Explain. 2

UNIT—III

4. (a) Distinguish between nucleotide and nucleoside. 2
- (b) Synthesize uracil from urea. 2

(5)

Or

Discuss briefly the mechanism of enzymatic action.

- (c) Explain the stereospecificity of enzyme with the help of a suitable example. Define coenzyme. 2+1=3

Or

Define genetic code. Write the important structural and functional differences between DNA and RNA. 1+2=3

- (d) Discuss briefly about the replication of DNA. 2

UNIT—IV

5. (a) Write in brief about the medicinal importance of azadirachtin present in neem. 2
- (b) Draw the structure of vitamin C and write about its medicinal importance. 2

Or

Synthesize paracetamol from *p*-nitrophenol.

- (c) Draw the structure of chloramphenicol and write in brief about its clinical properties. 1+2=3

Or

Write down the synthesis of anti-malarial drug chloroquine. 3

(d) Starting from acetanilide, write down the synthesis of sulphanilamide. 2

Or

Write down the green synthesis of ibuprofen.

UNIT—V

6. (a) Explain about special isoprene rule. 2

(b) In citral, one of the double bonds is at α, β -position with respect to aldehydic group. Explain. 2

(c) How will you synthesize citral from 6-methyl-hept-5-en-2-one? 2

Or

How can you synthesize α -terpineol starting from *p*-toluic acid?

(d) Write down the structure of *cis*- and *trans*-isomer of citral. 1

(7)

(Old Course)

Full Marks : 48

Pass Marks : 19

Time : 3 hours

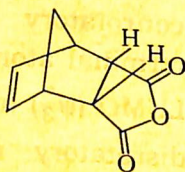
1. (a) Select the correct answer from the following : 1×3=3
- (i) The photochemical electrocyclic reaction of butadiene to cyclobutene occurs through
- (1) HOMO (ψ_2) having C_2 -axis of symmetry with conrotatory movement of the terminal atoms
 - (2) bonding (ψ_1) having σ -plane with conrotatory movement of the terminal atoms
 - (3) LUMO (ψ_3^*) having σ -plane with disrotatory movement of the terminal atoms
 - (4) antibonding (ψ_4^*) having C_2 -axis of symmetry with conrotatory movement of the terminal atoms
- (ii) DNA multiplication is called
- (1) translation
 - (2) transduction
 - (3) transcription
 - (4) replication

(iii) Ribose and 2-deoxyribose can be differentiated by

- (1) Fehling's reagent
- (2) Osazone formation
- (3) Tollens' reagent
- (4) Barfoed's reagent

(b) Draw the structure of curcumin. Give one important use of it. 1

(c) Which diene and dienophile would you employ to synthesize the following compound? 1



UNIT—I

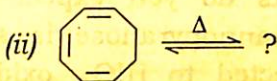
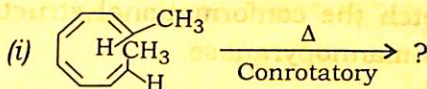
Answer *any one* question

2. (a) Draw the π -molecular orbitals of 1,3-butadiene. Identify the HOMO and LUMO and find out their symmetry elements.

$$1 + \frac{1}{2} + \frac{1}{2} = 2$$

- (b) Predict the stereochemical products obtained in the following reactions :

1×2=2



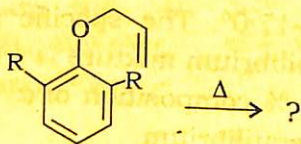
- (c) How can you convert *trans*-5,6-dimethyl-1,3-cyclohexadiene into its *cis*-isomer? 2

- (d) What is sigmatropic rearrangement? 1

3. (a) What are suprafacial-sigmatropic shift and antarafacial-sigmatropic shift? Explain the facts with [1, 5] sigmatropic rearrangement reaction(s). 2

- (b) With the help of FMO approach, show that [4+2] cycloaddition is thermally allowed but [2+2] cycloaddition is thermally forbidden. 3

- (c) Complete the following reaction and suggest the mechanism : 2

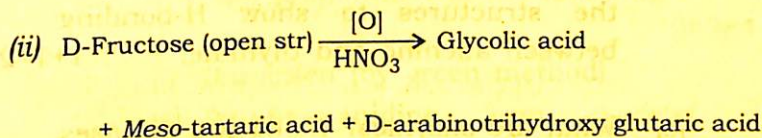
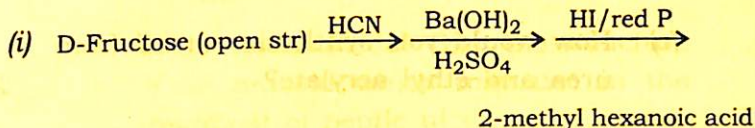


UNIT—II

Answer *any one* question

4. (a) Sketch the conformational structure of α -D-mannopyranose. 1
- (b) What products do you expect when methyl α -D-mannopyranose is subsequently subjected to HIO_4 oxidation, $\text{Br}_2/\text{H}_2\text{O}$ oxidation, strontium salt formation and hydrolysis with dil. HCl ? 3
- (c) Establish the cyclic structure of D-glucose. 3
- (d) Complete the following reaction : 2
- $$\text{D-Glucose} \xrightarrow{3\text{PhNHNH}_2} \text{Osazone} \xrightarrow{\text{dil. HCl}} \text{Osone}$$
- $$\xrightarrow{\text{Zn/AcOH}} \text{a Ketohexose}$$
- (e) What is epimerization? Explain it considering the conversion of D-glucose to D-mannose. 2
5. (a) The specific rotation of α -D-mannopyranose is $+29.3^\circ$ and that β -D-anomer is -17.0° . The specific rotation of the equilibrium mixture is $+14.2^\circ$. Calculate the % composition of α - and β -anomers at equilibrium. 2

(b) Complete the following reactions : 1½×2=3



(c) Explain that two C-2 epimeric aldose D-erythrose and D-threose give the same lower aldose by the Ruff degradation. 3

(d) What is mutarotation? Why does D-glucose show the phenomenon of mutarotation? 1+2=3

UNIT—III

Answer any **one** question

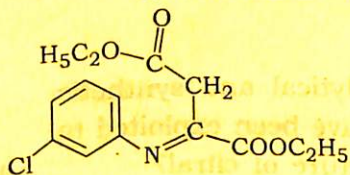
6. (a) Draw the structures of adenosine (aribonucleoside) and deoxycytidine (a deoxyribonucleoside). 1+1=2

- (b) What is the difference between DNA and RNA on the basis of bases they contain? 1
- (c) How would you synthesize uracil from urea and ethyl acrylate? 2
- (d) What are complementary bases? Draw the structures to show H-bonding between adenine and thymine. $1+1=2$
- (e) What are enzymes? Name two diseases caused due to the deficiency of enzymes. 2
7. (a) Draw the structure of the nucleotide of ATP. 1
- (b) Synthesize guanine from guanidine by using Traube's synthesis. 2
- (c) Discuss briefly the mechanism of enzymatic action. 2
- (d) What is coenzyme? Give one example. $\frac{1}{2}+\frac{1}{2}=1$
- (e) How does DNA replicate? How is the process responsible for preservation of heredity? $1+2=3$

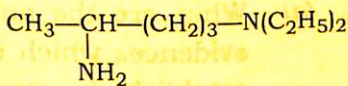
UNIT—IV

Answer *any one* question

8. (a) What are antacids? Give the structure of an antacid which may use in the treatment of peptic ulcer. 1+1=2
- (b) Give the preparation of the following : 2×2=4
- (i) Ibuprofen (by green method)
- (ii) Sulphaguanidine from *p*-acetyl sulphanil chloride
- (c) What are antipyretics and analgesics? Discuss the mode of action of antipyretics and analgesics. 1+1+1=3
9. (a) What are gram positive and gram negative bacteria? Give two examples for each. Draw the structure of an antibiotic which is active against certain gram positive and gram negative bacteria. 1+1+1=3
- (b) Using the following diester and amino-alkane, how would you synthesize an anti-malarial drug? 3



Diester



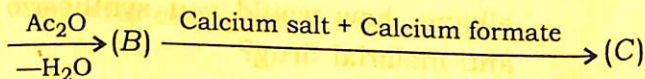
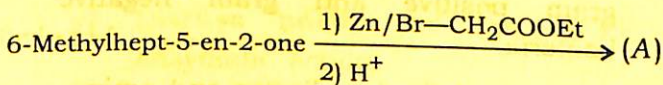
5-diethylamino 2-aminopentane

- (c) (i) What are the main constituents of dettol?
(ii) What is tincture of iodine? What is its use?
(iii) Synthesize paracetamol. 1+1+1=3

UNIT—V

Answer *any one* question

10. (a) Draw geometrical isomers of citral. What happens when both the isomers are treated with $(\text{Na} + \text{C}_2\text{H}_5\text{OH})$ followed by the treatment of an acid catalyst? 1+1+1=3
- (b) How would you synthesize α -terpineol from *p*-toluic acid? 2
- (c) Complete the following reaction : 2



11. (a) What are the analytical and synthetic evidences which have been exploited to establish the structure of citral? 4

(15)

- (b) What happens when citral is condensed with acetone in the presence of $\text{Ba}(\text{OH})_2$ followed by the treatment with dil. H_2SO_4 in presence of glycerol? 2
- (c) Giving one example, state isoprene rule. 1

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