2024

CHEMISTRY

(Honours Core)

Paper : CHE–HC–6026

(Organic Chemistry–V)

Full Marks : 60

Time : Three hours

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

1. Answer the following questions : $1 \times 7 = 7$

   (a) Give an example of triphenylmethane
   dye.

   (b) Write the name of the five-membered
   cyclic hemeacetal form of D-ribose.

   (c) Draw the structure of the product
   obtained from sodium borohydride
   reduction of D-glucose.

   (d) In which region NMR spectra are
   observed ?

(e) Which of the following statements is false about glucose?

(i) It is a reducing sugar.

(ii) It is a disaccharide.

(iii) It has a pyranose structure.

(iv) It is a polyalcohol.

(f) Fill up the blank:

Two monosaccharides are joined through a ___ bond to form a disaccharide.

(g) Mention the configuration of natural rubber.

2. Give answer of the following: 2×4=8

(a) Draw the Fisher projection diagram of the tetroses.

(b) Name the monomer units of Buna-S-rubber.

(c) (i) Between nitrobenzene and nitrophenol which one is more intensely coloured?

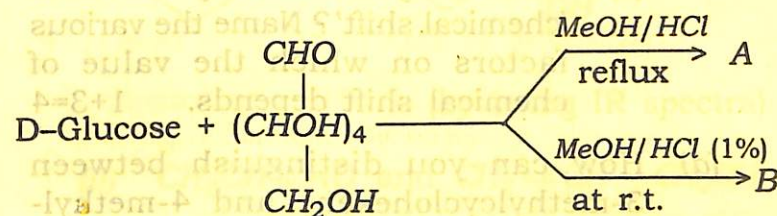(ii) What are the commonly encountered transitions in UV spectroscopy?

(d) Fill up the blanks:

Starch contains about 20% of a water-soluble fraction called _____ and 80% of water-insoluble fraction called _____.

3. Answer *any three* of the following: 5×3=15

(a) (i) Find out A and B in the following reaction: 2

$$\text{D–Glucose} + (CHOH)_4 \begin{array}{c} CHO \\ | \\ | \\ CH_2OH \end{array}$$
MeOH/HCl reflux → A
MeOH/HCl (1%) at r.t. → B

(ii) Write the synthesis of methyl orange. 3

(b) Write true *or* false for the following statements: 1×5=5

(i) Fructose exists as both pyranose and furanose structures.

(ii) The simplest carbohydrate is glyceraldehyde.

(iii) Galactose is not a disaccharide.

(iv) Hydrolysis of starch with dil.H_2SO_4 at $393K$ under pressure gives glucose.

(v) Glucose is also known as dextrose.

(c) (i) Fill up the blank :   1

No two compounds except the ____ can have similar IR-spectra.

(ii) What do you mean by the term 'chemical shift'? Name the various factors on which the value of chemical shift depends.   1+3=4

(d) How can you distinguish between 3-methylcyclohexene and 4-methyl-cyclohexene on the basis of mass spectroscopy ?

(e) Write short notes on : *(any two)* 2½×2=5

(i) Zeigler-Natta polymerisation

(ii) Amylose

(iii) Volcanization of rubber
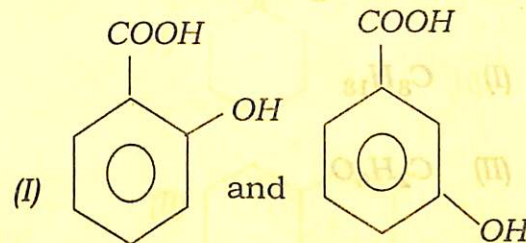
(iv) Degree of polymerisation

4. Answer *any three* of the following : 10×3=30

(a) (i) Define absorbance.   1

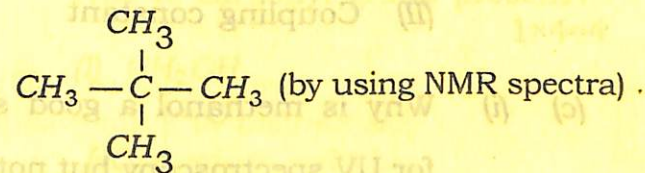(ii) How will you differentiate between the following pairs of compounds ? 3×3=9

(I) [structure: benzene ring with COOH and OH groups] and [structure: benzene ring with COOH and OH groups]

(by using IR spectra)

(II) CH_3CH_2CHO and $CH_2 = CH - CH_2OH$

(by using IR spectra)

(III) $CH_3 - CH_2 - CH_2 - CH_3$ and

$$CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - CH_3 \text{ (by using NMR spectra)}$$
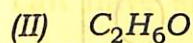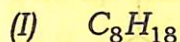
(b) (i) Predict the structural formula for the compounds with the following molecular formulas showing only one PMR signal each : 2×2=4

(I) C_8H_{18}

(II) C_2H_6O

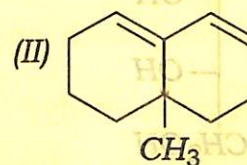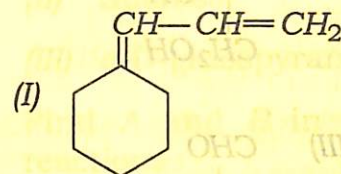(ii) Why is TMS used as a reference standard in NMR spectroscopy ? 3

(iii) Define : 1½×2=3

(I) Spin-spin splitting

(II) Coupling constant

(c) (i) Why is methanol a good solvent for UV spectroscopy but not for IR spectroscopy ? 2

(ii) By using the Woodward-Fieser rules, calculate the absorption maximum for the following compounds : 2×2=4
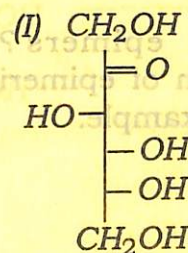
(I)

(II)
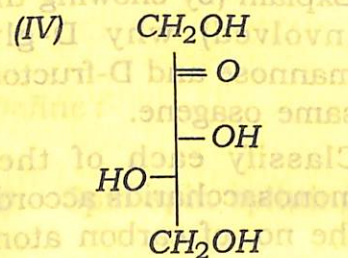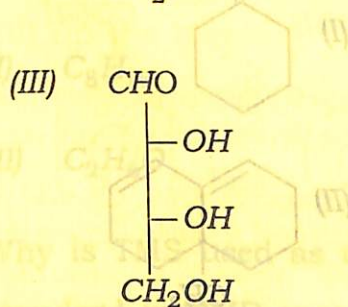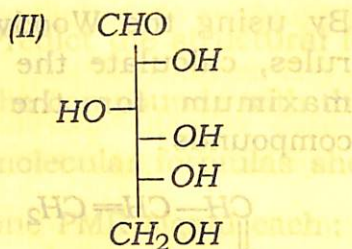

(iii) Explain (by showing the reactions involved) why D-glucose, D-mannose and D-fructose form the same osagene. 4

(d) (i) Classify each of the following monosaccharids according to both the no. of carbon atoms and the type of carbonyl group present : 1×4=4

(I)

$$
\begin{array}{c}
CH_2OH \\
=O \\
HO- \\
-OH \\
-OH \\
CH_2OH
\end{array}
$$

(II)

CHO
—OH
HO—
—OH
—OH
CH$_2$OH

(III)

CHO
—OH
—OH
CH$_2$OH

(IV)

CH$_2$OH
=O
—OH
HO—
CH$_2$OH

(ii) **What are epimers? Give the mechanism of epimerisation with suitable example.** 1+5=6

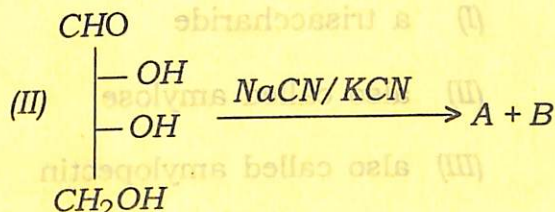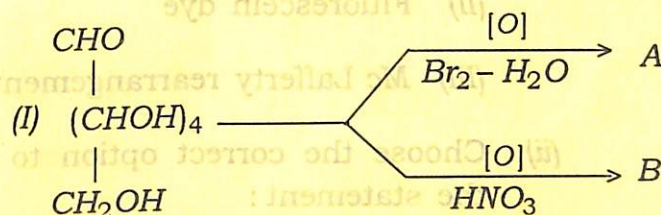*(e)* *(i)* Give the Haworth projection diagram of : *(any two)* 1½×2=3

(I) Lactose

(II) Sucrose

(III) α-D-glucopyranose

(ii) Find A and B in the following reactions : 2+2=4

(I)

CHO
|
(CHOH)$_4$
|
CH$_2$OH

$\xrightarrow[Br_2-H_2O]{[O]}$ A

$\xrightarrow[HNO_3]{[O]}$ B

(II)

CHO
—OH
—OH
CH$_2$OH

$\xrightarrow{NaCN/KCN}$ A + B

(iii) Draw the most stable conformer of—

(I)   α-D-glucose, and

(II)   β-D-mannose.

(in polar solvent)   1½×2=3

(f)   *(i)* Explain with suitable example : *(any two)*   2×2=4

(I)   Chain-growth polymerisation

(II)   Fluorescein dye

(III)   Mc Lafferty rearrangement

(ii) Choose the correct option to fill the statement :   1

"Starch is____."

(I)   a trisaccharide

(II)   also called amylose

(III)   also called amylopectin

(IV)   mixture of amylose and amylopectin

(iii) Give *one* example of each of the following :   1×2=2

(I)   Carbohydrate that acts as a biofuel.

(II)   Write two uses of congo red.

(iv) Illustrate the process of Killiani-Fisher synthesis of an aldotetrose from an aldotriose.   3

_____

(iii) Draw the most stable conformer of—

   (I) α-D-glucose, and

   (II) β-D-mannose.

      (in polar solvent) $1\frac{1}{2} \times 2 = 3$

(f) *(i)* Explain with suitable example : *(any two)* $2 \times 2 = 4$

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   (II)   Fluorescein dye

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