Total No. of Printed Pages—7

6 SEM TDC CHMH (CBCS) C 14

2024

(May)

CHEMISTRY

(Core)

Paper : C–14

(Organic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×5=5

(a) The pair of isomers which cannot be distinguished by infrared spectroscopy is

(i) *cis-* and *trans*-isomers

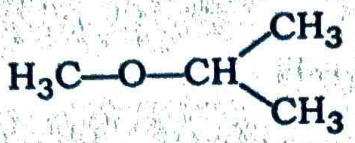
(ii) tautomers

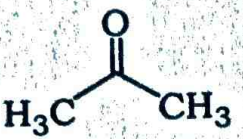
(iii) enantiomers

(iv) diastereoisomers

(b) Which of the following compounds shows two PMR signals?

(i) 

(ii) 

(iii) 

(iv) 

(c) Which of the following pairs gives the same osazone?

(i) Sucrose and fructose

(ii) Mannose and fructose

(iii) Glucose and galactose

(iv) Maltose and lactose

(d) Which of the following is not an example of thermoplastic plastic?

(i) Teflon

(ii) Dacron

(iii) Epoxy resin

(iv) Nylon

(Continued

(e) Azo dye is produced by the interaction of an aromatic diazonium chloride with

(i) aliphatic primary amine

(ii) nitrous acid

(iii) phenol

(iv) aromatic aldehyde

UNIT—I

2. Answer the following questions (any *five*) : 2×5=10

(a) Why does $nb \rightarrow \pi^*$ transition for carbonyl group shift to lower wavelength on increasing the polarity of solvent?

(b) How could you distinguish among 1°, 2° and 3° amines by infrared spectroscopy?

(c) The mass spectra of two different isomeric cycloalkanes show molecular ion peak at $m/z = 98$. One of them shows a base peak at $m/z = 69$ and the other at $m/z = 83$. Identify the cycloalkanes.

(d) What is Larmor frequency? How is it related to the external magnetic field strength?

(e) How can you distinguish between *cis*- and *trans*-stilbene with the help of UV-visible spectroscopy?

(f) CH_3OH is good solvent for UV-visible spectroscopy but bad solvent for infrared spectroscopy. Explain briefly.

3. Conjugated diene has high λ_{max} than isolated diene. Explain with suitable example. 3

Or

The mass spectra of a hydrocarbon show an abundant molecular ion peak at *m/e* 120. UV-visible spectrum indicates aromatic character. NMR spectrum indicates signal at 1·2δ (*d*, 6*H*), 2·8δ (*m*, 1*H*) and 7·2δ (*s*, 5*H*). Determine the structure of the hydrocarbon and explain the spectral data.

4. Answer the following questions (any *two*) : 4×2=8

(a) The PMR signal for vinylic proton is observed at high δ-value compared to acetylenic proton. Explain.

(b) An organic compound having molecular formula C_4H_8O gives characteristic band at 275 nm (ε_{max} 17) in its UV spectrum. In infrared spectrum, two peaks at 2940–2855 cm^{-1} and 1715 cm^{-1} are observed. In the mass spectrum, peak at *m/e* 29 and 15 is observed. PMR spectrum of the compound is as follows :

δ2·5 (*q*, 2*H*), δ2·12 (*s*, 3*H*) and δ1·07 (*t*, 3*H*)

Identify the compound and explain the band/peak.

(c) What is base peak? With the help of IR spectroscopy, how can you study H-bonding in *ortho-* and *para-* nitrophenol?

UNIT—II

5. Answer the following questions (any *three*) : 2×3=6

(a) Glucose, mannose and fructose give same osazone. Explain.

(b) How will you convert D-glucose to D-mannose?

(c) Draw the conformers of α-D and β-D glucose. Which conformer is more stable?

(d) Why does anomeric —OH group undergo methylation with CH_3OH and HCl under reflux but others do not?

6. Explain mutarotation with probable mechanism. 3

UNIT—III

7. Answer the following questions : 2×3=6

(a) What do you mean by the terms 'chromogen', 'bathochrome', 'auxochrome' and 'hypsochrome'?

(b) β-carotene is orange red in colour. Account for the origin of its colour.

(c) Discuss briefly the quinonoid theory for colour and constitution.

8. Write one synthesis each of the following : 1½×2=3

(a) Bismark brown

(b) Malachite green

Or

Account for the colour change when phenolphthalein is used as indicator in acid-base titration. 3

UNIT—IV

9. Discuss the mechanism of free-radical addition polymerization having AIBN as free-radical generator. 3

Or

Write short notes on isotactic, syndiotactic and atactic polymers.

10. Answer the following questions : 2×3=6

(a) What is natural rubber? How does it differ from gutta-percha?

(b) Write a short note on plasticizer.

(c) Write down at least two uses of Bakelite and PVC.

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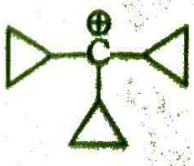
1. Choose the correct answer from the following : 1×5=5

(a) Which of the following is the most stable carbocation?

(i) $\overset{+}{C}H_3$

(ii) 

(iii) Ph_3C^+

(iv) $(CH_3)_3C^+$

(b) How many chiral carbons are present in the given molecule?

(i) 1

(ii) 2

(iii) 3

(iv) None of the above

(c) Which halogen does not react appreciably with methane in a free-radical substitution reaction?

(i) Chlorine

(ii) Bromine

(iii) Iodine

(iv) Fluorine

(d) According to Baeyer's strain theory, which is highly stable?

(i) Cyclobutane

(ii) Cyclopentane

(iii) Cyclohexane

(iv) Cyclopropane

(e) Which of the following annulenes is aromatic?

(i) [8] annulene

(ii) [10] annulene

(iii) [12] annulene

(iv) None of the above

UNIT—I

2. Answer the following questions : 2×3=6

(a) Explain the structure of ethane molecule with the help of hybridization.

(b) Define electrophilic reagent and nucleophilic reagent. Select the electrophilic and nucleophilic reagents from the following :

H_2O, BF_3, CH_3OH, SO_3

Or

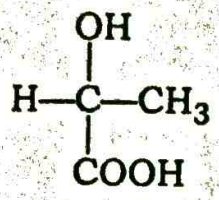
Phenol is less acidic than benzoic acid. Explain.

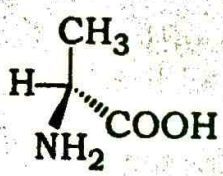
(c) What is activation energy of a reaction? Draw the energy profile diagram of two-step reactions.

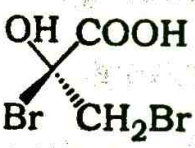
UNIT—II

3. Answer the following questions (any *six*) : 2×6=12

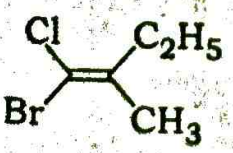
(a) Specify the following stereoisomers as *R* and *S* (any *two*) :

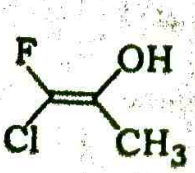
(i) 

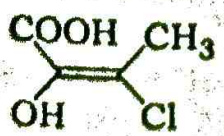
(ii) 

(iii) 

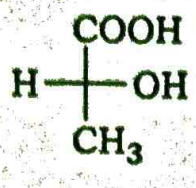
(b) Specify the following geometrical isomers as *E* and *Z* (any *two*) :

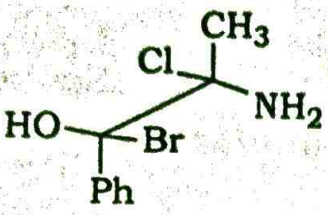
(i) 

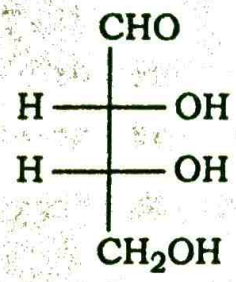
(ii) 

(iii) 

(c) Interconvert the following projections as directed (any *two*) :

(i)  (to flying wedge projection)

(ii)  (to Newman projection)

(iii)  (to Newman projection)

(d) Define the following terms :

(i) Resolution

(ii) Racemization

(e) Draw the stereoisomers of tartaric acid and mention their optical activities.

(f) Draw the *erythro*- and *threo*-isomer of 3-bromobutan-2-ol.

(g) What is Walden inversion? Explain with suitable example.

UNIT—III

4. Answer the following questions :

(a) How will you synthesize ethane from methane? 2

(b) Distinguish between Saytzeff and Hoffmann eliminations. 2

(c) On reductive ozonolysis, an unsaturated hydrocarbon produced butanone and ethanal. Identify the hydrocarbon. 2

(d) Explain the relative reactivity of ethylene, propylene and isobutylene towards electrophilic addition with HBr. 3

(e) Explain Diels-Alder reaction with suitable example. 2

(f) What happens when pent-1-yne is treated with H_2O in the presence of H_2SO_4 and $HgSO_4$ catalysts? Write down the reaction. 2

(g) What are the different states of carbene? Explain briefly. 3

Or

Acetylene is acidic in nature. Explain.

UNIT—IV

5. *(a)* What are the postulates of Baeyer's strain theory? 2

(b) Cyclopropane is the least stable member of cycloalkanes. How do you justify this in terms of orbital picture of 3-membered rings? 2

(c) How will you prepare cyclohexane and cyclobutane by using cycloaddition reactions? 2

(d) Show the flagpole hydrogens, their interactions and the eclipsed bonds on the side of boat conformation from an end view. 2

Or

Why is twist boat form of cyclohexane more stable than boat form?

UNIT—V

6. *(a)* Why is naphthalene aromatic? 2

(b) Discuss the mechanism of nitration of benzene. 2

(c) Alkylation of benzene with *n*-propyl chloride gives isopropyl benzene rather than *n*-propylbenzene. Explain. 2

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