



**2024/FYUG/EVEN/SEM/
CHMDSC-151T/084**

FYUG Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMDSC-151T

(Organic Chemistry—I)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

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

SECTION—A

Answer any ten questions :

2×10=20

- 1. What is hyperconjugation? How does it differ from mesomeric effect?** **1+1=2**
- 2. Cyclohexylamine is a stronger base than aniline. Explain.**

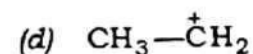
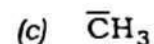
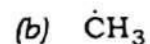
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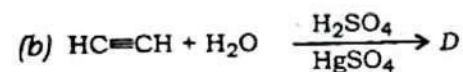
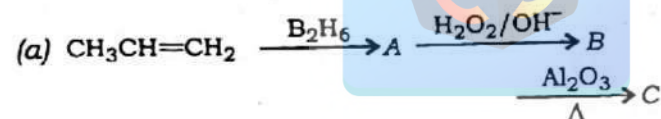
(2)

3. Indicate the type of hybridization on each carbon atom in the following species : $\frac{1}{2} \times 4 = 2$



4. Corey-House reaction is better method for preparing alkanes than Wurtz reaction. Explain, why.

5. Identify A, B, C and D :



6. Write a short note on Diels-Alder reaction.

7. What are aromatic, antiaromatic and nonaromatic compounds? Give one example of each.

(3)

8. In organic synthesis, Friedel-Crafts acylation is preferred to alkylation. Explain with an example.

9. How will you convert benzene into—

(a) 2,4,6-trinitrotoluene;

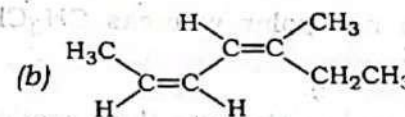
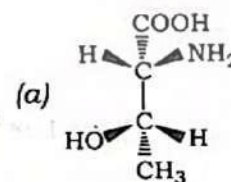
(b) *p*-nitrobromobenzene?

1+1=2

10. Represent the anti- and fully-eclipsed conformations of 2,3-butanediol by Newman and Sawhorse projection formulae.

11. Assign R, S or E, Z notations to the following :

1+1=2





(4)

12. Define the following terms with example : 1+1=2

(a) Diastereoisomers

(b) Enantiomers

13. What do you mean by invert sugar? Why is it named so? 1+1=2

14. Write a short note on 'mutarotation'.

15. Why is sucrose a non-reducing sugar? Give the Haworth representation of the structure of sucrose. 1+1=2

SECTION—B

Answer any five questions : 10×5=50

16. (a) Explain why : 1½×2=3

(i) CCl_4 is non-polar whereas CH_3Cl is polar.

(ii) Formic acid is stronger than acetic acid.

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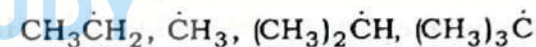
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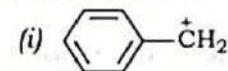
(b) What do you understand by the term 'resonance'? How does it differ from inductive effect? How will you explain the acidic character of phenol by resonance? 1+1+2=4

(c) What do you mean by electrophile and nucleophile? Explain with suitable examples. 1½+1½=3

17. (a) Arrange the following in increasing order of stability and justify your answer : 2



(b) Draw the canonical structure and resonance hybrid of the following species : 1½+1½=3



(c) What are carbenes? How are they formed? Discuss their types, structures and stability. 1+1+3=5

18. (a) What happens, when *cis*-2-butene and *trans*-2-butene are brominated? Write the product and the mechanism. 4

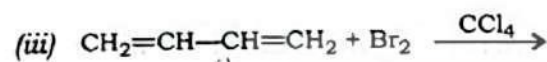
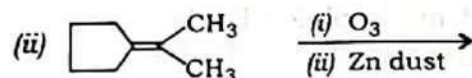
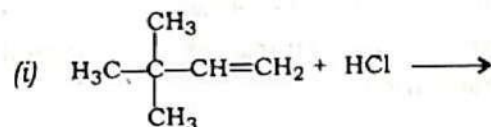
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(6)

- (b) Complete the following reactions and write the mechanism : $2 \times 3 = 6$



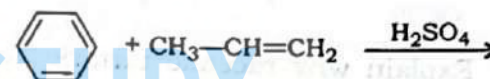
19. (a) State Markovnikov's rule and explain the mechanism of addition of HBr to propene in the presence of peroxide. $1 + 2 \frac{1}{2} = 3 \frac{1}{2}$
- (b) Discuss the mechanism of allylic bromination taking a suitable example. $2 \frac{1}{2}$
- (c) Give one example of Hofmann elimination reaction. 1
- (d) A primary alcohol A ($\text{C}_6\text{H}_{14}\text{O}$) on treatment with hot sulphuric acid yields an unsaturated compound B (C_6H_{12}), which on ozonolysis, gives a mixture of compound C ($\text{C}_2\text{H}_4\text{O}$) and butanone. Deduce the structure of A, B and C, and write the chemical reaction of each step. 3

(7)

20. (a) Explain the following : $1 \frac{1}{2} + 1 \frac{1}{2} = 3$

- (i) Nitration of toluene can take place more readily than that of benzene.
- (ii) Nitrobenzene is used as a solvent in Friedel-Crafts reaction.

- (b) Discuss the mechanism of sulphonation of benzene. $2 \frac{1}{2}$
- (c) Complete the following reaction and write the mechanism : $2 \frac{1}{2}$



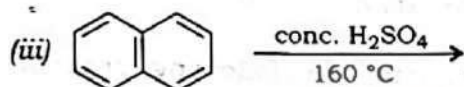
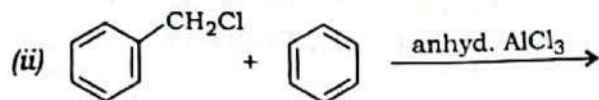
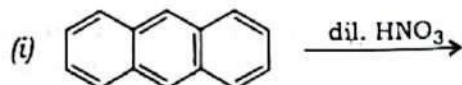
- (d) Explain why anthracene is more likely to undergo electrophilic substitution at the 9 position. 2
21. (a) Write the Haworth synthesis of naphthalene from benzene. 3
- (b) Give evidence in favour of the fact that—
- (i) naphthalene is a bicyclic compound;
- (ii) anthracene has diene character. $2 \frac{1}{2} + 1 \frac{1}{2} = 4$



(8)

(c) Complete the following reactions :

3



22. (a) Explain why racemic tartaric acid can be resolved but not mesotartaric acid. Give the chemical method of resolution of racemic lactic acid.

$1\frac{1}{2} + 2\frac{1}{2} = 4$

(b) What are conformers? Describe the different conformations of *n*-butane with energy diagrams.

$1 + 3 = 4$

(c) Explain why chair conformation of cyclohexane is more stable than boat conformation.

2

23. (a) The presence of a chiral carbon in a molecule is not a necessary condition for showing optical activity. Explain.

2

(9)

(b) A racemic mixture of 2-butane showed a specific rotation of $+6.76^\circ$. The pure S-(+)-2-butanol gives specific rotation $+13.52^\circ$. What will be enantiomeric excess of S-(+)-2-butanol and actual composition of its enantiomeric mixture?

$2\frac{1}{2}$

(c) Discuss the conformations of 1,3-disubstituted cyclohexane and explain their stability.

3

(d) Discuss Sachse-Mohr theory of stainless rings.

$2\frac{1}{2}$

24. (a) What are the limitations of open-chain structure of glucose? How is the ring size of glucose molecule established?

$1\frac{1}{2} + 2\frac{1}{2} = 4$

(b) Give Kiliani-Fischer synthesis of D-glucose from D-arabinose.

3

(c) Explain the following with necessary chemical reactions :

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

(i) Glucose and fructose give the same osazone.

(ii) Fructose reduces Tollens reagent although it is a ketohexose.



(10)

25. (a) Write a short note on Ruff's degradation of an aldohexose to aldopentose. $2\frac{1}{2}$
- (b) Convert glucose into fructose. 2
- (c) Establish the fact that—
- (i) carbonyl group in fructose is a keto group;
 - (ii) sucrose contains a α -glycosidic linkage. $1+1\frac{1}{2}=2\frac{1}{2}$
- (d) Draw the chair conformation of starch and cellulose and indicate the glycosidic linkage in each structure. 3



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