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DEPARTMENT: MECHANICAL ENGINEERING

MATRIC NUMBER: 19/ENG06/036

COURSE: CHEM 102

ASSIGNMENT

1. Name the functional groups present in each of the following molecules
- i) $\text{CH}_2=\text{C}(\text{OH})\text{HCHO}$ ii) $\text{C}_6\text{H}_5\text{CH}(\text{NH}_2)\text{COCH}_3$ iii) $\text{CH}_3\text{C}=\text{CHCH}(\text{OH})\text{CHO}$

Answer

Molecules	Functional groups
i) $\text{CH}_2=\text{C}(\text{OH})\text{HCHO}$	- Aldehyde ($\text{C}-\text{CHO}$) - Hydroxyl group ($\text{C}-\text{OH}$)
ii) $\text{C}_6\text{H}_5\text{CH}(\text{NH}_2)\text{COCH}_3$	- Carbonyl group ($\text{C}-\text{CO}$) - Amine ($\text{C}-\text{NH}_2$)
iii) $\text{CH}_3\text{C}=\text{CHCH}(\text{OH})\text{CHO}$	- Hydroxyl group ($\text{C}-\text{OH}$) - Aldehyde ($\text{C}-\text{CHO}$)

2. A 0.856g sample of pure (2R, 3R)-tartaric acid was diluted to 10cm^3 with water and placed in a 1.0dm polarimeter tube. The observed rotation at 20°C was $+1.0^\circ$. Calculate the specific rotation of (2R, 3R)-tartaric acid.

Solution

$$[\alpha] = \frac{\alpha}{cl}$$

where $[\alpha]$ = specific optical rotation

α = observed rotation

c = concentration in g/cm^3

l = pathlength (in dm)

$$\alpha = +1.0^\circ$$

$$l = 1.0 \text{ dm}$$

$$c = ?$$

$$\text{Concentration in g/cm}^3 = \frac{0.8569}{10 \text{ cm}^3} = 0.08569 \text{ g/cm}^3$$

$$\text{Specific rotation} = \frac{\text{observed rotation (degrees)}}{(\text{Concentration in g/cm}^3) \times (\text{path length of sample cell in dm})}$$

$$[\alpha]_D^{25} = \frac{\alpha}{c \cdot l}$$

$$[\alpha]_D^{25} = \frac{+1.0^\circ}{0.08569 \text{ g/cm}^3 \times 1.0 \text{ dm}} = +11.682^\circ \text{ g}^{-1} \text{ cm}^3 \text{ dm}^{-1} \text{ or } +11.682^\circ$$

∴ The specific rotation of (2R, 3R)-tartaric acid is $+11.682^\circ \text{ g}^{-1} \text{ cm}^3 \text{ dm}^{-1}$ or $+11.682^\circ$

3 Draw the possible geometric isomers (where possible) for each of the following compounds:

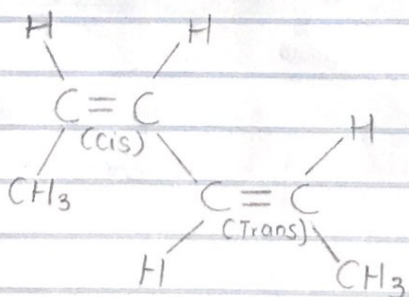
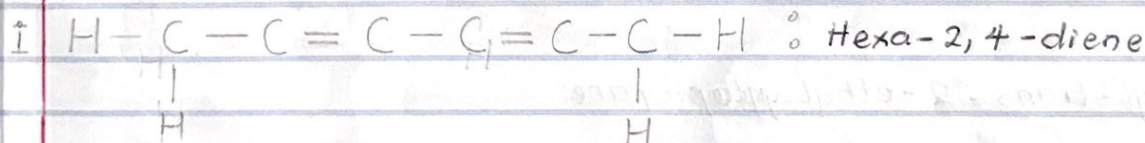
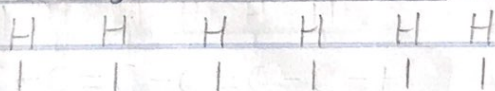
i) Hexa-2,4-diene

ii) 2,3-Dimethylbut-2-ene.

Answers

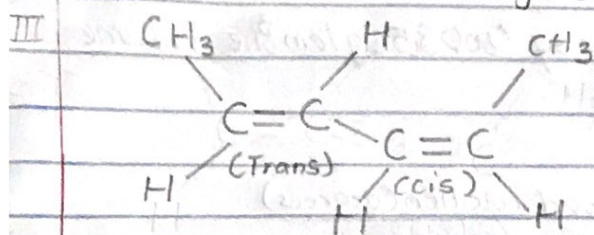
i) Hexa-2,4-diene $[\text{CH}_3\text{CH}=\text{CHCH}=\text{CHCH}_3]$

Possible geometric isomers

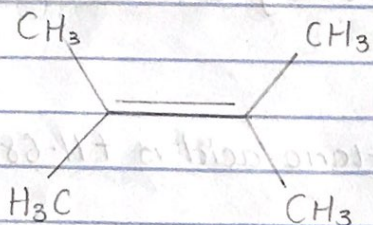


∴ Cis-1, trans-4-dimethylbut-2-ene

Trans-1, Cis-4-dimethyl but-2-ene

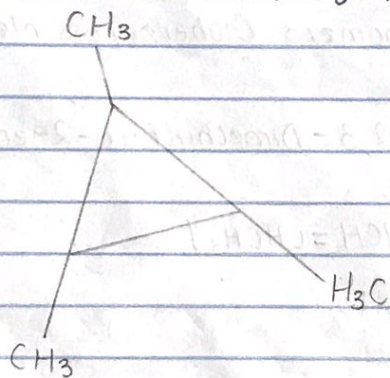


ii) 2,3-Dimethylbut-2-ene

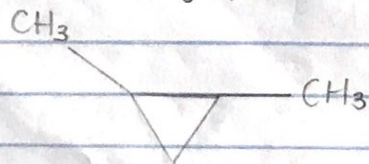


Possible Geometric Isomers

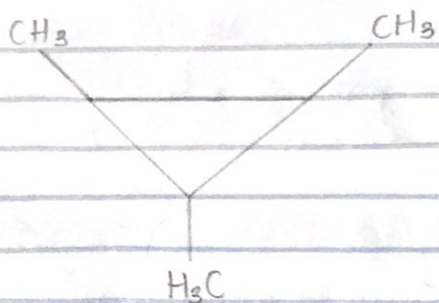
I 1-cis-2-trans-3-trimethylcyclopropane



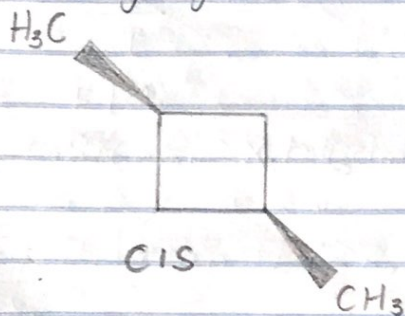
II 1-methyl-trans-2-ethylcyclopropane



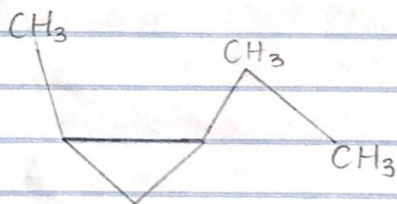
III cis-1,2,3-trimethylcyclopropane



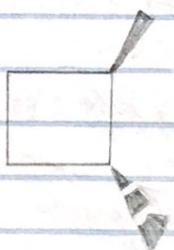
IV Cis-1,3-dimethyl cyclobutane



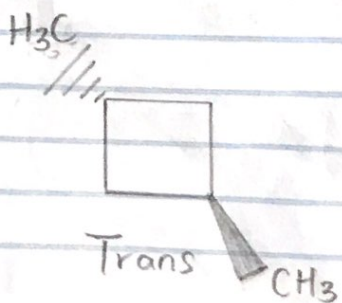
V Cis-1-methyl-2-ethyl cyclopropane



VI Trans-1,2-dimethyl cyclobutane



VII Trans-1,3-dimethyl cyclobutane



viii Trans - 2-hexene

