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Building Ball-and-Stick Molecular Models

Experiment 13 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To construct representative molecules and explain geometry, connectivity and selected isomerism.

Principle

Ball-and-stick models represent atoms and bonds, while idealised local geometry is related to bonding. Single-bond rotation can produce conformers without changing connectivity; double bonds restrict rotation. Models are explanatory representations, not literal electron-density pictures.

Requirements

- Molecular-model kit with colour key and bond connectors; instructor-assigned structures.
- Drawing sheet for structural formulas, geometry labels and conformer comparison.

Procedure

1. Set the key

Record the atom-colour convention used by your kit rather than assuming every kit is identical.

2. Construct simple geometries

Build methane, ethene and ethyne. Compare tetrahedral, trigonal-planar and linear arrangements around the relevant carbons.

3. Build functional groups

Construct an alcohol, carboxylic acid, ester and amide. Show the atom connectivity and explain the group differences.

4. Aromatic model

Build benzene as a planar ring and discuss delocalisation; alternating model sticks are a representation, not fixed isolated double bonds.

5. Conformers and isomers

Rotate a single bond in ethane/butane and contrast this with cis/trans or E/Z possibilities for a suitable substituted alkene.

6. Draw the record

Translate each model into a clear structural formula and label the relevant geometry and functional group.

Observations and Record

Molecule / site	Idealised geometry	Approximate bond angle
Methane carbon	Tetrahedral	109.5°
Ethene carbon	Trigonal planar	120°
Ethyne carbon	Linear	180°
Benzene ring	Planar, delocalised	Near 120°

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Ethene has C_2H_4 with two trigonal-planar carbon centres. It does not have freely rotating C-C single-bond conformers.

Result

Record the observed outcome and calculated value, with units. State whether the stated laboratory specification was met; do not copy the worked example as your result.

Precautions

- Follow valence requirements and do not add bonds merely to fill every connector hole.
- Distinguish a conformer from a constitutional isomer; model colours are conventions.

Viva Questions and Answers

1. What changes in a conformer?

Spatial arrangement through permitted bond rotation without changing connectivity.

2. Why is ethyne linear?

The local carbon bonding geometry is approximately linear.

3. Does a benzene model prove fixed alternating bond lengths?

No. The ring is delocalised and the bond depiction is a teaching convention.

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