



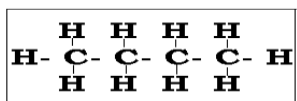
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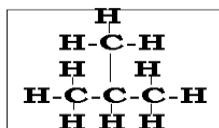
Section: Alkanes handout

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1. A functional group is part of a larger molecule; it is composed of an atom or group of atoms that have a characteristic chemical behavior. How many compound types of functional groups are you aware of?
2. What does the following skeletal structure illustrate? A straight or a branched-chain?

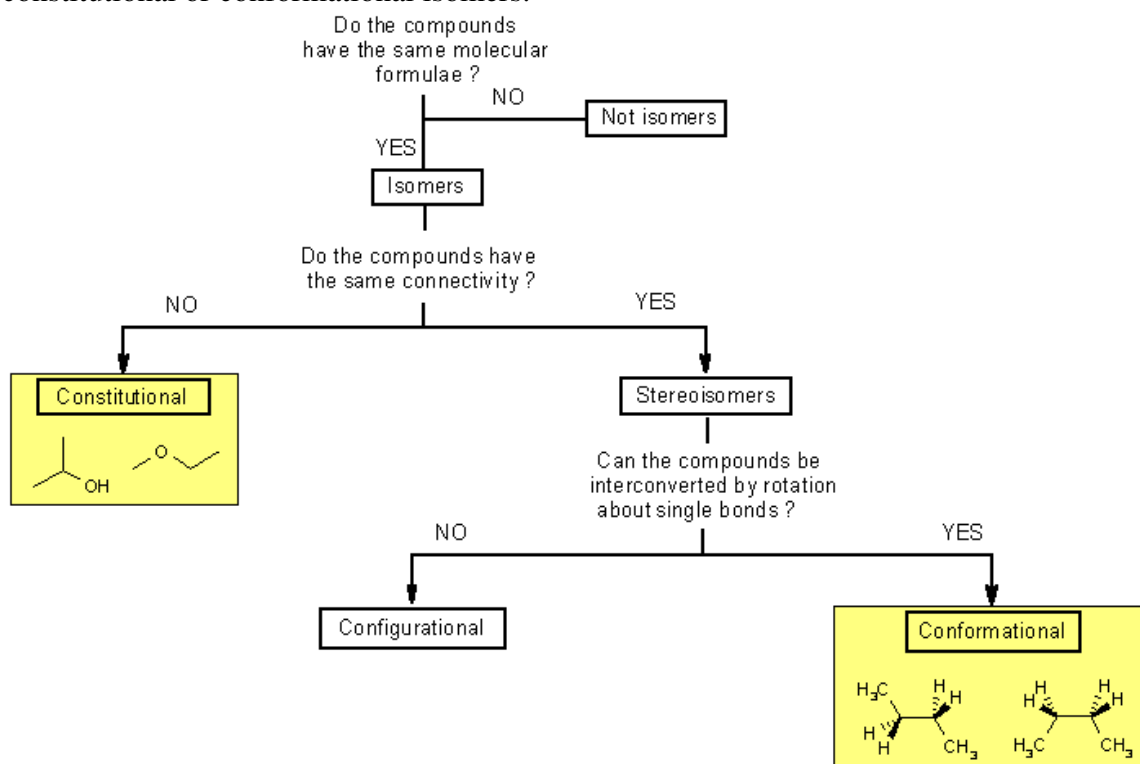


BUTANE



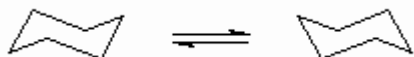
ISOBUTANE

3. How would you define a straight and a branched chain?
4. Define Conformation.
5. Look at the following diagram and say whether the isomers above are constitutional or conformational isomers.

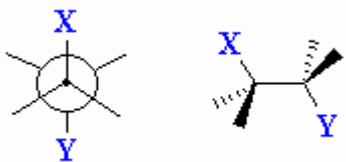


6. What types of conformations are you aware of?
7. The language of Conformation. Match the terms with their definition:
Puckered, Ring strain, Gauche, Chair, Boat, Ring flipping, Eclipsed, Staggered, Anti, Torsional angle:

- a. A non-planar geometry of a cyclic structure.
- b. The process by which a ring changes its conformation.

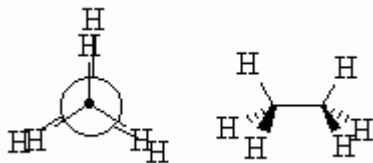


- c. Description given to two substituents attached to adjacent atoms when their bonds are at



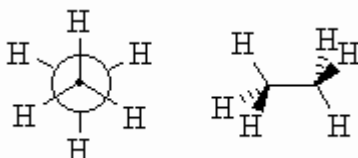
180° with respect to each other.

d. A high energy conformation where the bonds on adjacent atoms are aligned with each other.



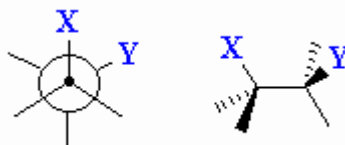
other.

e. A low energy conformation where the bonds on adjacent atoms bisect each other,



maximising the separation.

f. Description given to two substituents attached to adjacent atoms when their bonds are at

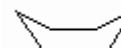


60° with respect to each other.

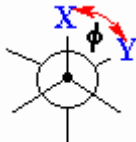
g. The most stable conformation for cyclohexane.



h. A high energy conformation of cyclohexane that occurs during ring flipping.



i. Angle between C-X and C-Y bonds in a X-C-C-Y system when viewed along the C-C bond. Rotation about the C-C bond will change this torsional angle. This is also known as a dihedral angle.

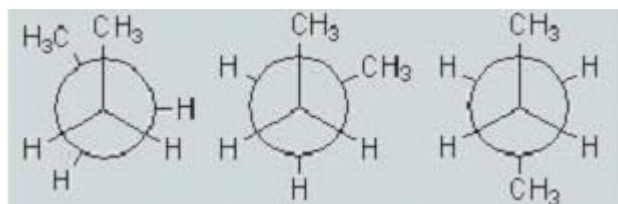


j. The destabilisation of a cyclic structure compared to a related non-cyclic structure, mainly due to angle and torsional strain. This extra energy is released when the ring is broken.

For more information visit:

<http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch03/ch3-0-1.html>

8. **Conformational isomers** are normally best seen using Newman Projections. What conformations do they depict? Chair, boat gauche, eclipsed, anti?



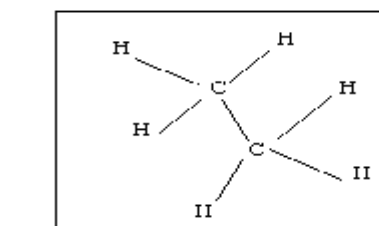
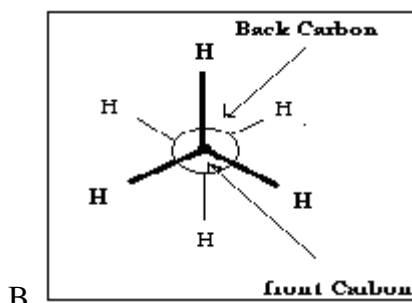
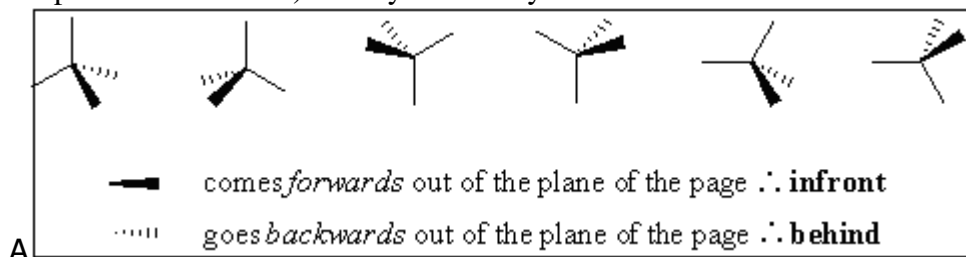
9. What determines the IUPAC nomenclature of branched-chain alkanes?

_____ PREFIX _____ PARENT _____ SUFFIX _____

10. What is the IUPAC name of this alkane?



11. The arrangement of a chemical compound can be represented in different ways. (Sawhorse representation, wedge-dashed, Newman projection (staggered or eclipsed conformation)) Can you identify which one is illustrated in each case?



12. Define Sawhorse and Newman projection denoting their differences.

13. Look at the arrangement of the staggered and eclipsed conformation of ethane (in the text) and define each, focusing on their differences.

14. A skeletal structure is a shorthand way of drawing structures that show only bonds, not atoms.

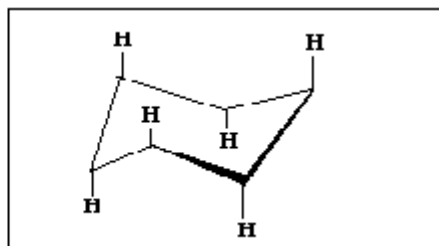
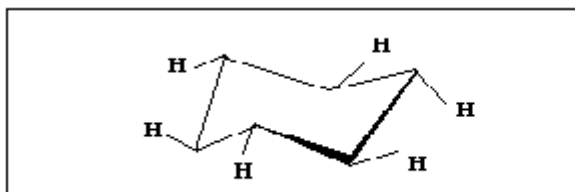
Can you describe the rules for drawing a skeletal structure?

15.

16. Cyclo-alkanes are represented by polygons in skeletal drawings. Can you list them?

17. Which one is puckered into three-dimensional arrangement called chair conformation?

18. The chair conformation of cyclohexane leads to many consequences. One is that there are two kinds of positions for hydrogens on the ring. Look at the following figure. Which are they?



11. Explain how axial bonds are different from equatorial bonds.

Vocabulary:			
Functional group	Λειτουργική ομάδα	formula	(Μοριακός)τύπος
Reactivity	Αντιδραστικότητα	Boat conformation	Διαμόρφωση λουτήρα
Formula	μοριακός τύπος	Axial bond	Αξονικός δεσμός
inert	Αδρανής	Equatorial bond	Ισημερινός δεσμός
Straight-chain	Ευθείας αλυσίδας	Axial substituent	Αξονικός υποκαταστάτης
Branched-chain	Διακλαδισμένη αλυσίδας	Newman projections	Προβολές Νιούμαν
nomenclature	Ονοματολογία	Sawhorse representation	Πλαγιογωνιακή αναπαράσταση
Constitutional isomers	Συντακτικά ισομερή	cycloalkanes	κυκλοαλκάνια
Rotation	Περιστροφή	ring	Δακτύλιος
Axis	άξονας	Disubstituted cycloalkanes	Διυποκατεστημένα Κυκλοαλκάνια
conformation	διαμόρφωση	Strain-free	Χωρίς παραμόρφωση
Staggered conformation	Διαβαθμισμένη διαμόρφωση	Ring flip	Αναστροφή δακτυλίου
Eclipsed conformation	Καλυπτική διαμόρφωση	interconvert	Αλληλομετατρέπω
Chair conformation	Διαμόρφωση ανακλίντρου	Gauche conformation	Περικλινής διαμόρφωση

12. Read the text and complete the gaps with the appropriate word. Not all the words are used.

Propane	ethane	pentane	tetrahedral
Carbon	succeeding	methane	degrees
Paraffin	single	formula	saturated
Sigma	double	surrounding	substituents
nonane			

The alkanes (i.e. the.....) are the simplest homologous series of organic compounds of hydrogen and....., where all atoms are linked by..... bonds.

The generalfor the alkane series of hydrocarbons is C_nH_{2n+2} . The alkanes are said to bebecause the maximum number of bonds are formed between each carbon atoms and its neighbouring carbon and hydrogen atoms. The lack of any multiple bonds (i.e.-bonds or triple-bonds) in the alkanes explain the relative chemical inertness of this series of hydrocarbons.

M.....	CH ₄	CH ₄
E.....	C ₂ H ₆	CH ₃ CH ₃
P.....	C ₃ H ₈	CH ₃ CH ₂ CH ₃
Butane	C ₄ H ₁₀	CH ₃ CH ₂ CH ₂ CH ₃
Pentane	C ₅ H ₁₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃
Heptane	C ₆ H ₁₄	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
Hexane	C ₇ H ₁₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
Octane	C ₈ H ₁₈	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
N.....	C ₉ H ₂₀	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
D.....	C ₁₀ H ₂₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃

The shapes of the alkanes shows that all bonds on the carbon atoms are identical and that the bond angles are close to 109..... Thus, each carbon atom is at the center of a tetrahedral structure. All bonds between carbon atoms (i.e. C-C bonds), or between a carbon atom and hydrogen (i.e. C-H bonds), are s bonds (..... bonds).

Alkanes Linear Structure

The alkane with the simplest structure is methane, CH₄. Each member of the alkane series has a further methylene group, -CH₂-, in the chain. The methane molecule consists of a central carbon atom, by four hydrogen atoms, with a shape.

Notes

Reference Note

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<https://opencourses.uoc.gr/courses/course/view.php?id=355>

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