Question 1

Make a model of fluorocyclohexane and measure the distance between the fluorine atom and the #4 carbon of the cyclohexane in BOTH chair conformations. If you do not have proper chairs, you will NOT get the correct answer! Use beige bonds for the C-C bonds and a green bond for the C-F bond. Bond lengths are defined as the distance between the two NUCLEI, measure from atom center to atom center. Photographs of the 2 chairs are provided, but you will need to build your own model. Use the conversion factor 1Å = 2.6 cm

A distance axial = 5.6Å distance equitorial = 6.3Å
B distance axial = 4.8Å distance equitorial = 5.5Å
C distance axial = 4.0Å distance equitorial = 4.7Å
D distance axial = 3.3Å distance equitorial = 4.0Å
Question 2
MC19c

What is the IUPAC name for the following molecule?

A 3,5-diethyl-4-(1,2-dimethylpropyl)nonane
B 2,3-dimethyl-5-ethyl-4-(1,2-dimethylpropyl)nonane
C 5-ethyl-4-(1-ethylpropyl)-2,3-dimethylnonane
D 4-(1,2-dimethylpropyl)-3,5-diethylnonane
Question 3
MCalkanes4

The energy difference between the highest and lowest energy conformers for rotation around the C2-C3 bond in 2-methylpentane is?

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<thead>
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<th>Use These Interaction Energies, kcal/mol</th>
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A 6.25 kcal/mol  
B 5.30 kcal/mol  
C 4.35 kcal/mol  
D 4.95 kcal/mol

1) start by drawing the structure  
2) identify the bond we are concerned with, and "look" from either end

note, it doesn't matter which group points in which direction in the Newman projections, it is the RELATIVE positions that need to be correct

LOWEST ENERGY CONFORMATION  
HIGHEST ENERGY CONFORMATION

Energy difference = (1.4 + 1.0 + 2.9) - 0.95 = 4.35 kcal/mol
Question 4
MC19e

Looking down the C₂ - C₃ bond, which is the lowest energy conformation of 2,3-dimethylbutane?

largest number of substituents "anti-" and smallest number of gauche interactions [G]

2,3-dimethylbutane
Question 5

Of the three isomeric C₃H₄ hydrocarbons shown below, how many can exist with all the carbon and hydrogen nuclei located in a single plane? This is a bit tricky, building a model may help, pay attention to the hybridizations of the various carbon atoms!

H₂C=CH₂

H₃C=C=CH

I

II

III

A = I only
B = II only
C = III only
D = None of them

The plane containing H–C₁–H is at right angles to the plane containing H–C₃–H. This molecule is not flat.

The molecule is flat around the H–C₁–C₂–H plane, and C₃ is in the same plane. However, C₃ is sp³ hybridized, and its 2 H's are another plane at 90° to the other plane. This molecule is not flat.

The atoms Ha–C₃–C₂–C₁–Hb all lie in a plane, but C₁ is sp³ hybridized, the Hc and Hd can not be the the same plane. This molecule is not flat.
Question 6

Internal rotation around the C₂-C₃ bond of 2-methylpentane results in three staggered conformations, how many different energies do the three staggered conformations possess, i.e. if they were all the same energy the answer would be 1, if 2 were the same and these two were different from the other one, the answer would be 2, etc. (this question will take some work!)

A = 1  
B = 2  
C = 3  
D = an infinite number

Here are all the high and low energy conformations (looking with C₃ in front and C₂ at the back):

- Two highest energy conformations with eclipsing interactions, the question does not ask about these, but they are given here for sake of completeness.
- One higher energy staggered conformation.
- Two lower energy staggered conformations.
Question 7
MCalkanes13
Build an HGS model of pentane. Rotate around the various C-C sigma bonds until you are in the fully staggered conformation, MAKE SURE YOU HAVE A PROPER STAGGERED CONFORMATION at all C-C bonds. Measure the distance between carbon #1 and carbon #5. Use the conversion factor 1Å = 2.6 cm

A 3.6 Å
B 4.0 Å
C 4.2 Å
D 4.8 Å

Here is a photograph of a model of pentane in the correct conformation

in my model this distance is ca. 12.5 cm
12.5 cm / 2.6 cm/Å ~ 4.8 Å
Question 8
MCalkanes10

Build an HGS model of 2-methylbutane. Rotate your structure around the C2-C3 bond to get into the lowest energy staggered conformation, **MAKE SURE YOU HAVE A PROPER STAGGERED CONFORMATION** (there are 2 of these conformations, either is OK). Measure the distance between carbon #1 (C₁) and carbon #4 (C₄) as indicated in the photograph. Use the conversion factor $1\text{Å} = 2.6 \text{ cm}$

- A 2.1 Å
- B 2.5 Å
- C 2.9 Å
- D 3.3 Å

Here is a photograph of a model of 3-methylbutane in the correct conformation around C2-C3

You must measure the distance **IN the correct staggered conformation**

**model is the correct STAGGERED CONFORMATION**

In my model this distance is ca. 7.5 cm

$7.5/2.6 = 2.88 \text{ Å}$