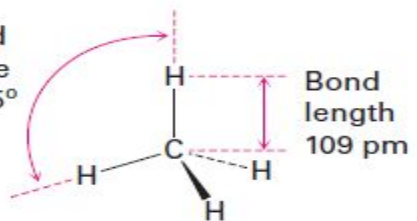


# АЛКАНЫ

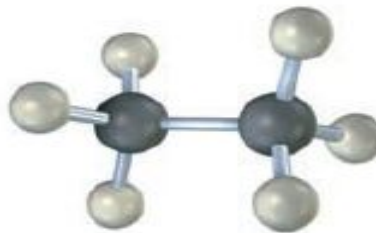
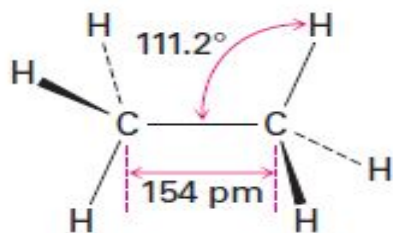
(строение и изомерия)



Bond angle  
 $109.5^\circ$



Bond length  
109 pm



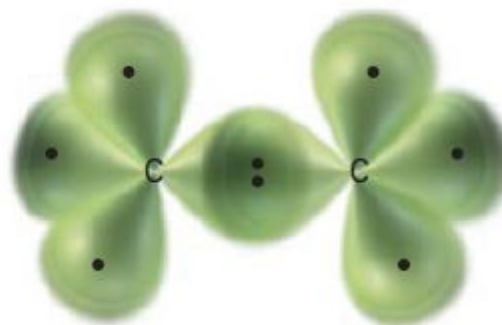
**Ethane**



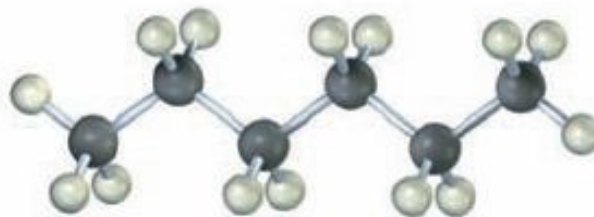
$sp^3$  carbon



$sp^3$  carbon

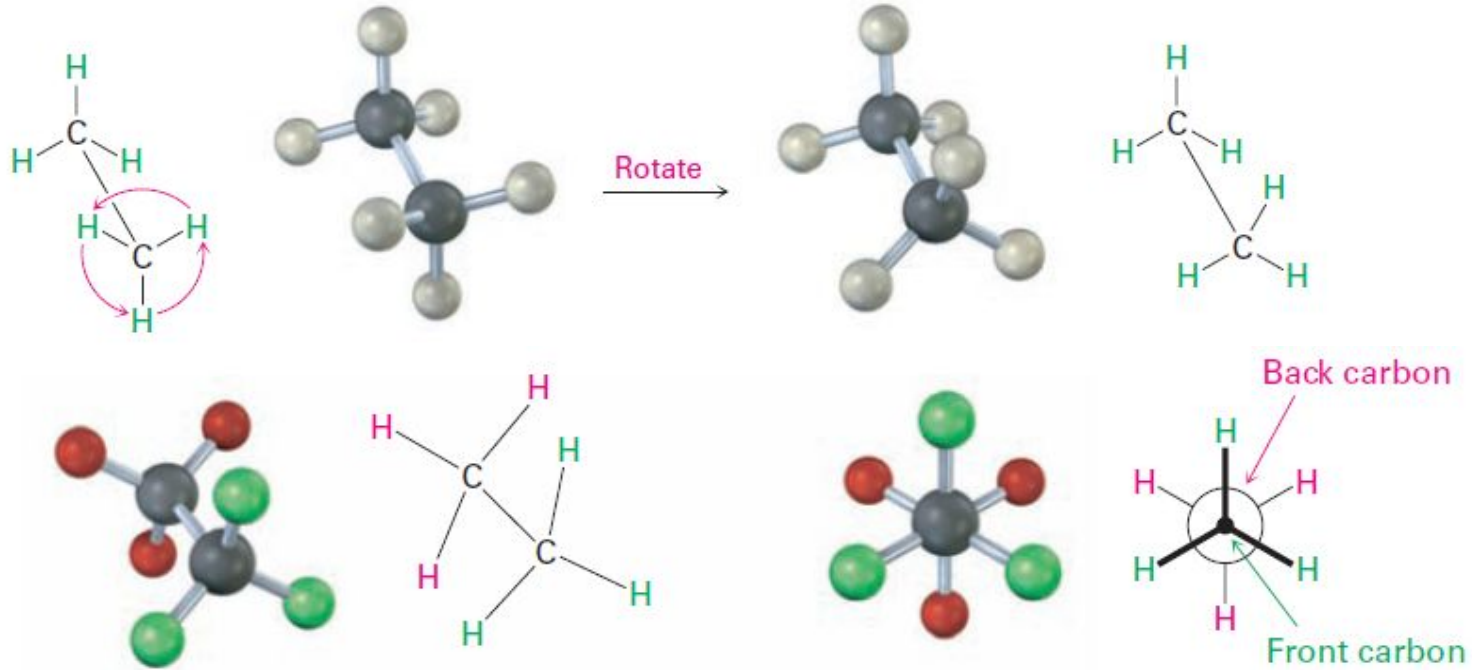


$sp^3-sp^3$   $\sigma$  bond



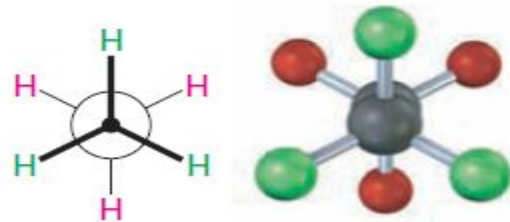
**Hexane**

# Конформации этана



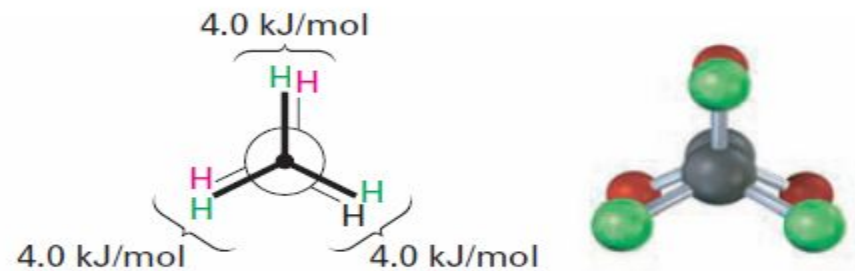
Sawhorse representation

Newman projection

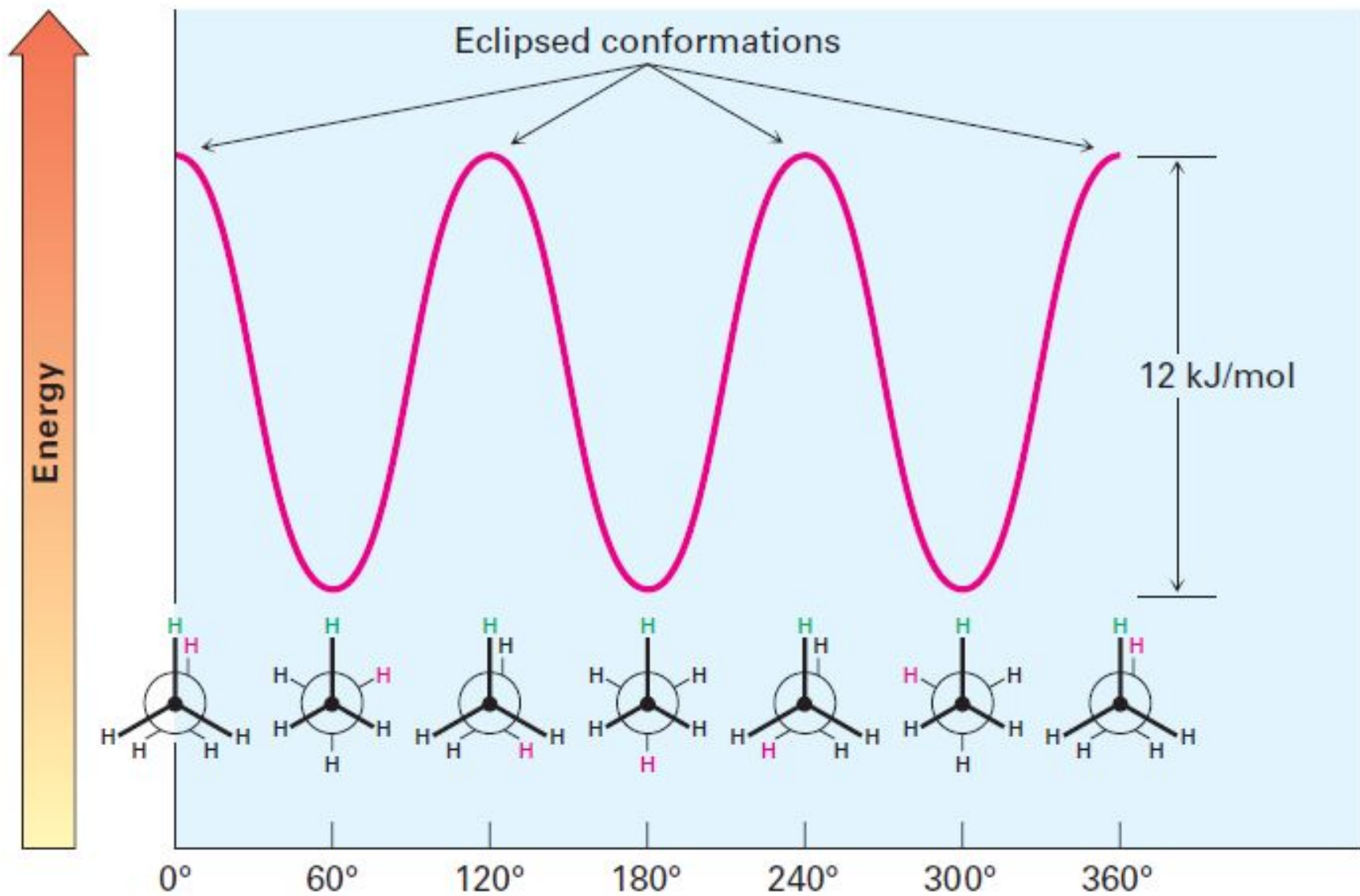


Ethane—staggered conformation

Rotate rear carbon 60°

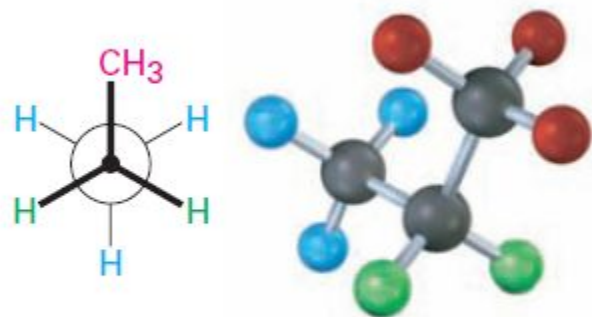


Ethane—eclipsed conformation

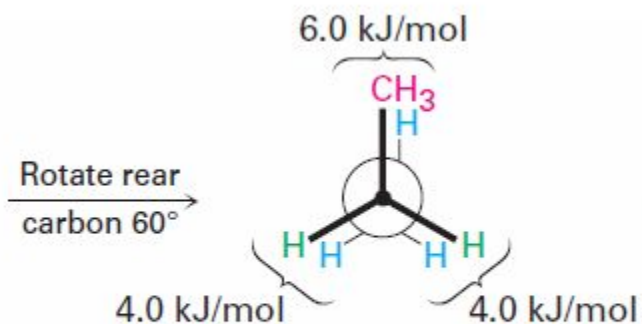


# Конформации пропана и бутана

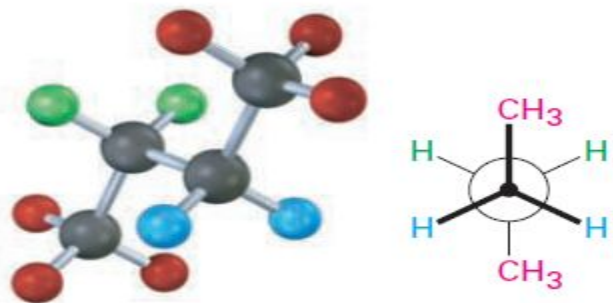
The eclipsed conformation of propane has three interactions—two ethane-type hydrogen–hydrogen interactions and one additional hydrogen–methyl interaction. Since each eclipsing  $\text{H} \leftrightarrow \text{H}$  interaction is the same as that in ethane and thus has an energy “cost” of 4.0 kJ/mol, we can assign a value of  $14 - (2 \times 4.0) = 6.0$  kJ/mol (1.4 kcal/mol) to the eclipsing  $\text{H} \leftrightarrow \text{CH}_3$  interaction



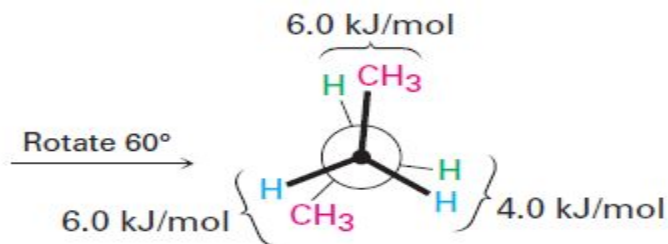
Staggered propane



Eclipsed propane



Butane—anti conformation  
(0 kJ/mol)

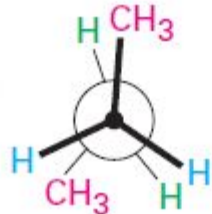


Butane—eclipsed conformation  
(16 kJ/mol)



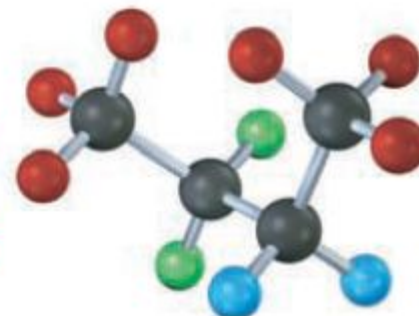
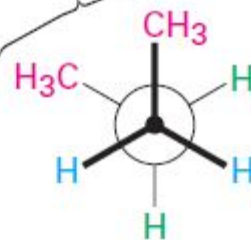


**Butane—eclipsed conformation**  
(16 kJ/mol)

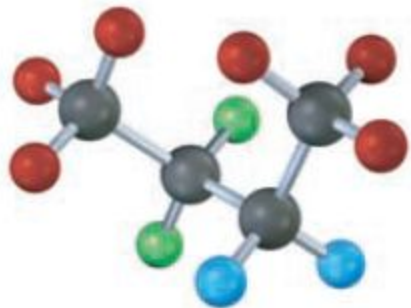


Rotate 60°

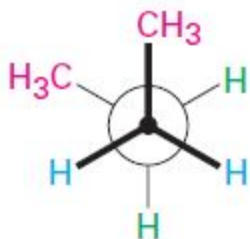
Steric strain  
3.8 kJ/mol



**Butane—gauche conformation**  
(3.8 kJ/mol)



**Butane—gauche conformation**  
(3.8 kJ/mol)



Rotate 60°

11 kJ/mol

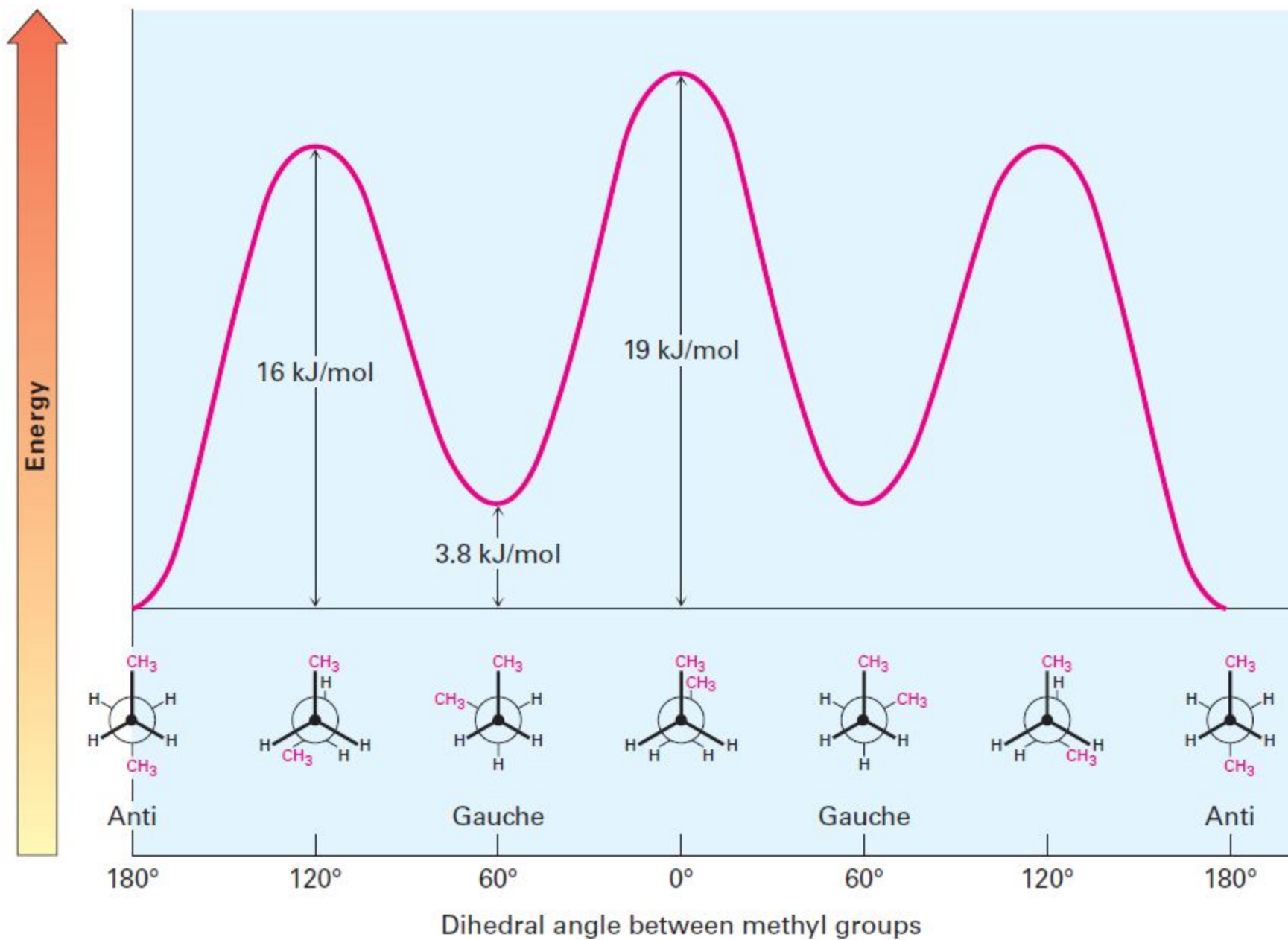


4.0 kJ/mol

4.0 kJ/mol



**Butane—eclipsed conformation**  
(19 kJ/mol)



**Table 3.5** Energy Costs for Interactions in Alkane Conformers

| Interaction                                | Cause                       | Energy cost |            |
|--|-----------------------------|-------------|------------|
|  |                             | (kJ/mol)    | (kcal/mol) |
| H ↔ H eclipsed                             | Torsional strain            | 4.0         | 1.0        |
| H ↔ CH <sub>3</sub> eclipsed               | Mostly torsional strain     | 6.0         | 1.4        |
| CH <sub>3</sub> ↔ CH <sub>3</sub> eclipsed | Torsional and steric strain | 11          | 2.6        |
| CH <sub>3</sub> ↔ CH <sub>3</sub> gauche   | Steric strain               | 3.8         | 0.9        |

Sight along the C2–C3 bond of 2,3-dimethylbutane, and draw a Newman projection of the most stable conformation.

Draw a Newman projection along the C2–C3 bond of the following conformation of 2,3-dimethylbutane, and calculate a total strain energy:





Sight along the C2–C1 bond, 2-methylpropane (isobutane) and

(a) draw a Newman projection of the most stable conformation.

(b) draw a Newman projection of the least stable conformation.

(c) make a graph of energy versus angle of rotation around the C2–C1 bond.

(d) Since an H ↔ H eclipsing interaction costs 4.0 kJ/mol and an H ↔ CH<sub>3</sub> eclipsing interaction costs 6.0 kJ/mol, assign relative values to the maxima and minima in your graph.

Consider 2-methylbutane (isopentane). Sighting along the C2–C3 bond:

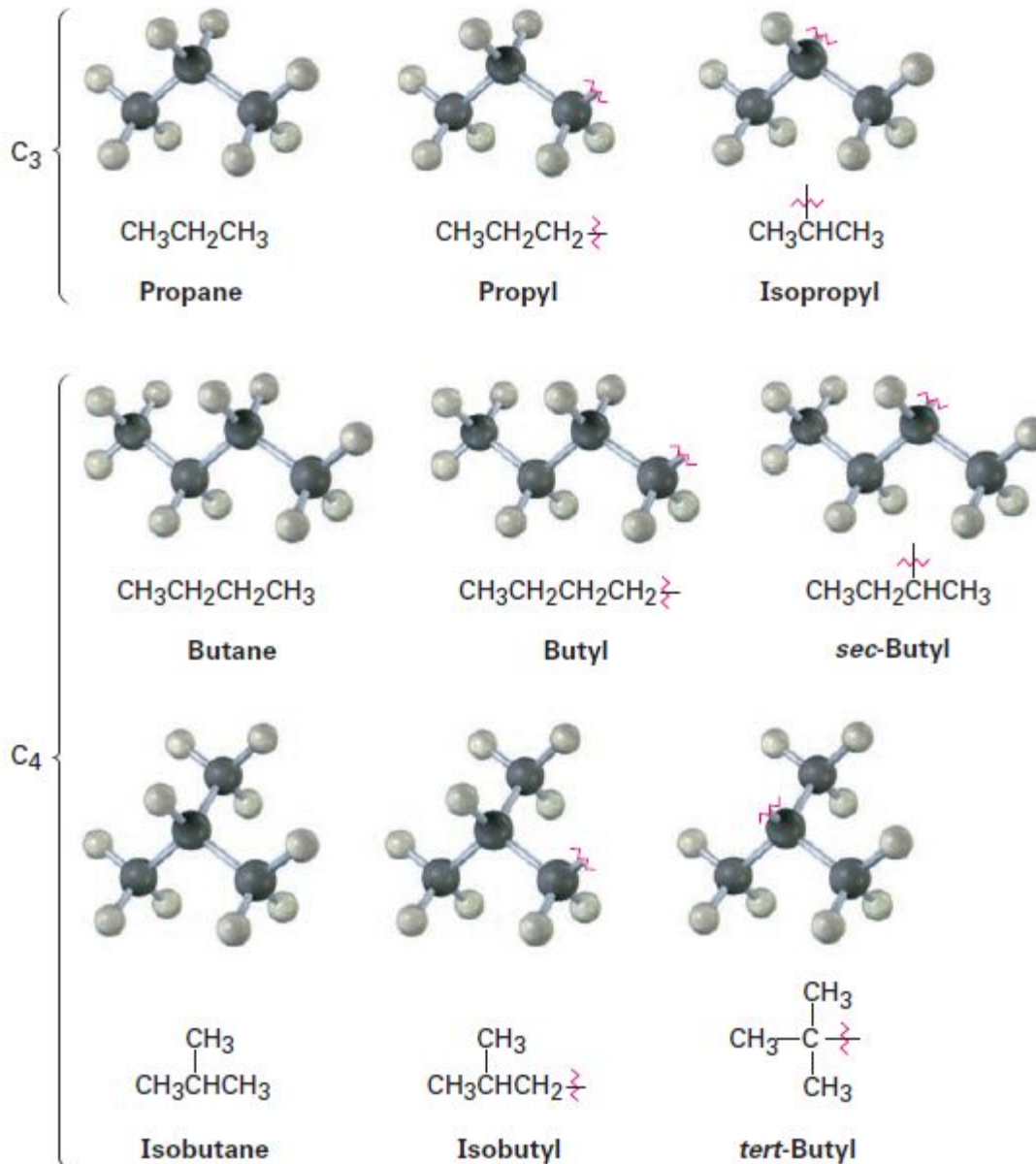
(a) Draw a Newman projection of the most stable conformation.

(b) Draw a Newman projection of the least stable conformation.

(c) If a CH<sub>3</sub> ↔ CH<sub>3</sub> eclipsing interaction costs 11 kJ/mol (2.5 kcal/mol) and a CH<sub>3</sub> ↔ CH<sub>3</sub> gauche interaction costs 3.8 kJ/mol (0.9 kcal/mol), make a quantitative plot of energy versus rotation about the C2–C3 bond.

Construct a qualitative potential-energy diagram for rotation about the C–C bond of 1,2-dibromoethane. Which conformation would you expect to be most stable? Label the anti and gauche conformations of 1,2-dibromoethane.

# Алкильные группы



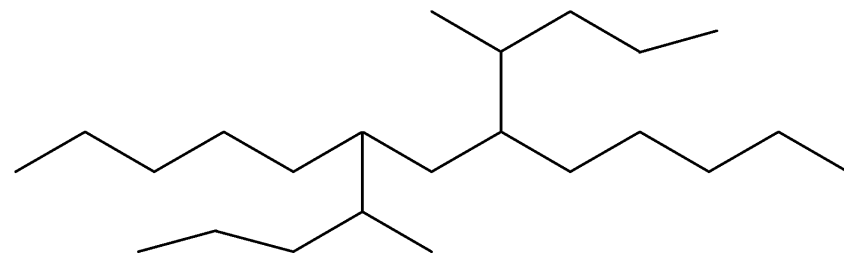
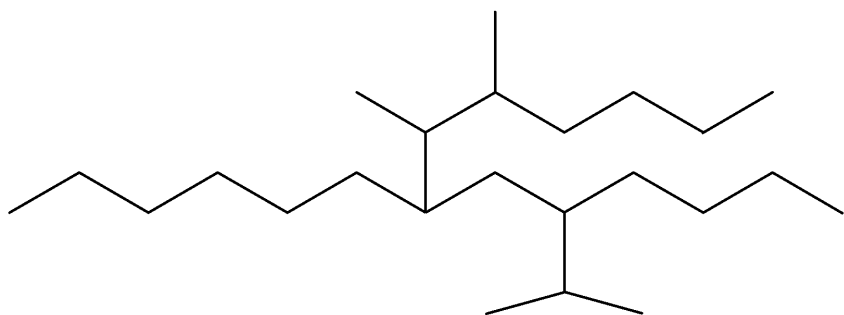
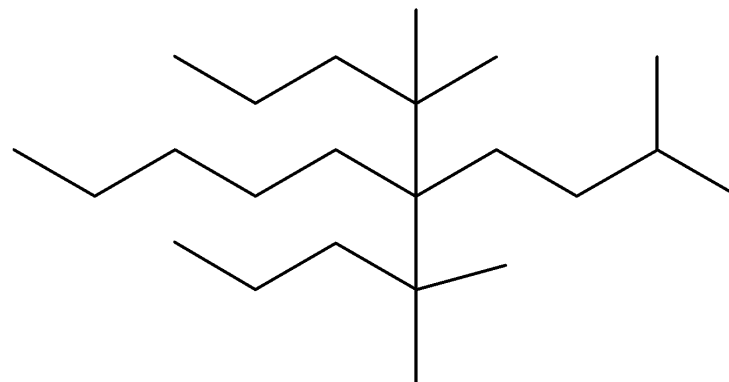
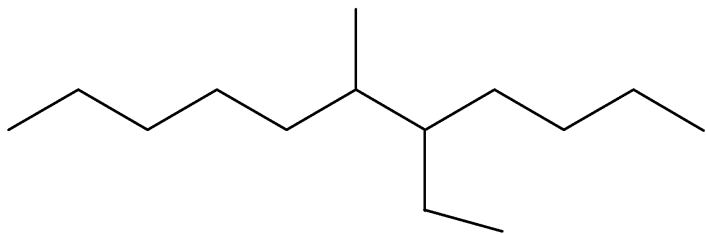
**Locant** — **Prefix** — **Parent** — **Suffix**

Where are the substituents and functional groups?

What are the substituents?

How many carbons?

What is the primary functional group?



Какой простейший алкан будет  
содержать энантиомер?

