

1. Draw each structure and classify each hydrogen as primary, secondary, or tertiary.
 - (a) methylcyclopentane
 - (b) 2,3-dimethylbutane
 - (c) 3-methyloctane
 - (d) 2,2-dimethylpentane

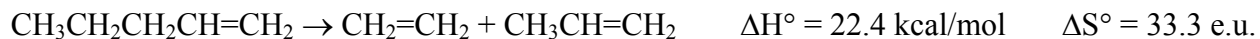
2. The chlorination of 2-methylbutane gives a mixture of four monochlorinated products.
 - (a) Draw 2-methylbutane and label the four possible sites for chlorination.
 - (b) If the combined yield of the two primary halide products is 41%, the secondary halide is formed in 36%, and the tertiary halide in 23%, compute the relative reactivity. (*Relative reactivity primary:secondary:tertiary*)

3. For each of the following compounds, predict (draw) the major product of free-radical bromination.
 - (a) methylcyclopentane
 - (b) 2,3-dimethylbutane
 - (c) 3-methyloctane
 - (d) 2,2-dimethylpentane

4. Calculate ΔH° values for the following reactions from bond energies in your book:
 - (a) $\text{H}_2 + \text{F}_2 \rightarrow 2\text{HF}$
 - (b) $\text{H}_2 + \text{I}_2 \rightarrow 2\text{HI}$
 - (c) $(\text{CH}_3)_3\text{CH} + \text{Br}_2 \rightarrow (\text{CH}_3)_3\text{CBr} + \text{HBr}$
 - (d) $(\text{CH}_3)_3\text{CH} + \text{Cl}_2 \rightarrow (\text{CH}_3)_3\text{CCl} + \text{HCl}$

5. Write a mechanism for the radical bromination of benzene (C_6H_6) (Label the initiation and propagation steps). Calculate ΔH° values for each step and for the overall reaction. How does this reaction compare thermodynamically with the bromination of other hydrocarbons? (Bond dissociation energies: $\text{C}_6\text{H}_5\text{-H}$ 111 kcal/mol, $\text{C}_6\text{H}_5\text{-Br}$ 81 kcal/mol)

6. Calculate the ΔG° at 25°C for the following reaction:



What is the effect of raising temperature on ΔG° ? What is the temperature at which the reaction becomes favorable? **Show units.**

7. Draw a reaction profile (potential energy diagram) to represent each of the following situations: **Label reactants, products, and activation energy.**

- (a) an exothermic reaction with a small activation barrier
- (b) an exothermic reaction with a large activation barrier
- (c) an endothermic reaction with a small activation barrier