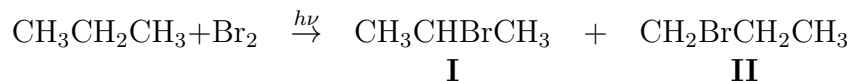


Problem set 1

Due October 27, 2026

1. The photochemical monobromination of propane results in a mixture of two isomers:



We assume that the reaction is subject to the thermodynamic control. The degeneration of each state (isomer) is equal to the number of propene's hydrogen atoms that can be replaced with a bromine atom to form the respective isomer.

It was found that, at the room temperature ($T=298\text{ K}$), the two isomers are formed in the following relative amounts: 97 % of 2-bromopropane (I) and 3 % of 1-bromopropane (II). Estimate the energy difference between the two isomers. Express it as $\Delta E = E_{II} - E_I$. Comment on the result obtained based on your organic chemistry knowledge.

2. Based on the solution of the first problem, compute the mean energy and the free energy of the equilibrium mixture of 2-bromopropane (I) and 1-bromopropane (II) at $T=298\text{ K}$.

The value of the universal gas constant is $R = 8,3145\text{ J}/(\text{mol}\cdot\text{K})$, $1\text{ kcal} = 4184\text{ J}$.