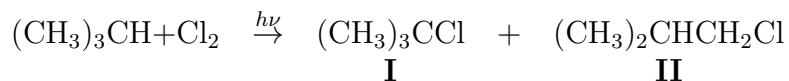


Problem set 3**Due March 28, 2024**

1. What ratio of the two possible products of photo-induced monochlorination of isobutane (2-methylpropane)



can be expected at room temperature ($T = 298 \text{ K}$) assuming that the reaction is controlled thermodynamically and that the energy difference between the two products $\Delta E = E_{II} - E_I = 1.66 \text{ kcal/mol}$?

Hint: Note that, if both isomers had the same energy, their relative populations would be determined by the number of hydrogen atoms possible to replace with a chlorine atom at the respective site(s).

2. To what temperature would gaseous oxygen in the ground triplet state ($^3\Sigma_g$, degeneracy 3) have to be heated to get 0.1 % of it excited to the singlet ($^1\Delta_g$, degeneracy 1) state? Singlet oxygen has energy by 21 kcal/mol higher than triplet oxygen.

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