

Answer on Question #54166 – Chemistry – Organic Chemistry

Question:

Rate law for the rxn of OH⁻ negative with tertiary Butyl bromide to form an elimination product in 75 % ethanol and 25 % water at 30°C is: $-r = 7.1 \times 10^{-5}$ (tertiary butyl bromide) (OH⁻) + 1.5×10^{-5} (tertiary Butyl bromide). What %age of the rxn takes place by E2 pathway when :- a) (OH⁻)= 5M , b) = 0.0025 M ?

Answer:

The rate for E1 and E2 elimination are shown as follows:

$$r(E1) = k_1[\text{tertiary butyl bromide}]$$

$$r(E2) = k_2[\text{tertiary butyl bromide}][\text{OH}^-]$$

and the summarized rate equals: $r = r(E1) + r(E2)$

$$\text{Thus, } r(E2)/r = r(E2)/[r(E1) + r(E2)] =$$

$$= k_2[\text{tertiary butyl bromide}][\text{OH}^-]/(7.1 \times 10^{-5} [\text{tertiary butyl bromide}] [\text{OH}^-] + 1.5 \times 10^{-5}[\text{tertiary Butyl bromide}]) =$$

$$= 7.1 \times 10^{-5} [\text{OH}^-]/(7.1 \times 10^{-5} [\text{OH}^-] + 1.5 \times 10^{-5})$$

Percentage value is defined by the equation:

$$\%(E2) = 7.1 \times 10^{-5} [\text{OH}^-]/(7.1 \times 10^{-5} [\text{OH}^-] + 1.5 \times 10^{-5}) \times 100\%$$

$$\text{A) Finally, at } [\text{OH}^-] = 5 \text{ M: } \%(E2) = [35.5/(35.5 + 1.5)] \times 100\% = 95.95 \%$$

and

$$\text{B) at } [\text{OH}^-] = 0.0025 \text{ M: } \%(E2) = [0.01775/(0.01775 + 1.5)] \times 100\% = 1.17 \%$$