ChemE 2200 - Physical Chemistry II for Engineers

Quiz 11 - April 16, 2025

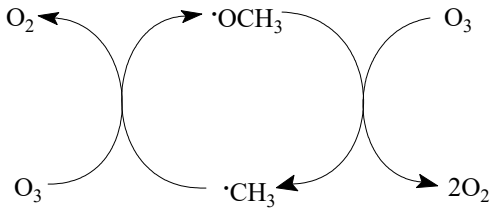
Name: *Solution*

(A) Reaction 1 creates two radicals from a molecule; reaction 1 is initiation. Radical $CH_3CH_2O^{\cdot}$ is involved in reaction 2 only; $CH_3CH_2O^{\cdot}$ is not a propagating radical. Reaction 2 converts $CH_3CH_2O^{\cdot}$ to a propagating radical, $^{\cdot}CH_3$. Reaction 3 converts one propagating radical, $^{\cdot}OCH_3$, into the other propagating radical, $^{\cdot}CH_3$. Reaction 4 consumes two propagating radicals; reaction 4 is termination. The second propagating reaction is reaction 5.

Summary:
Reaction 1: initiation
Reaction 2: initiation
Reaction 3: propagation
Reaction 4: termination
Reaction 5: propagation

(B) The overall reaction is the sum of the propagation reactions; $2O_3 \rightarrow 3O_2$. Ignore the CH_2O created in the initiation (radical transfer) reaction 2 and the CH_3CH_3 created in the termination reaction 4.

(C) Use reactions 3 and 5 to draw the propagation cycle.



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Name: Key

Consider the following chain reaction mechanism. (5 pts)

$$CH_3CH_2OOCH_3 \xrightarrow{k_1} CH_3CH_2O\cdot + \cdot OCH_3$$ Initiation +1

$$CH_3CH_2O\cdot \xrightarrow{k_2} \cdot CH_3 + CH_2O$$ Initiation +1

$$\cdot OCH_3 + O_3 \xrightarrow{k_3} \cdot CH_3 + 2O_2$$ propagation +1

$$\cdot CH_3 + \cdot CH_3 \xrightarrow{k_4} CH_3CH_3$$ termination +1

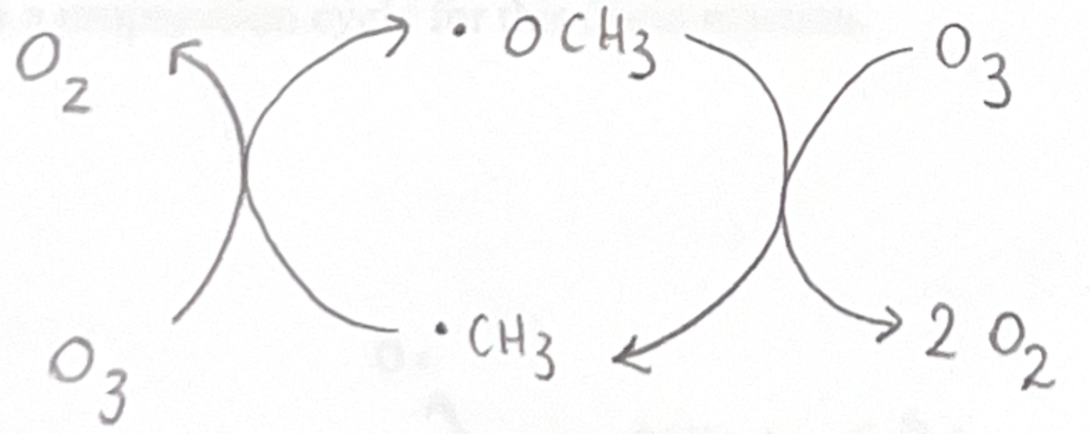
$$\cdot CH_3 + O_3 \xrightarrow{k_5} \cdot OCH_3 + O_2$$ propagation +1

(A) Classify the elementary reactions in the terminology of chain reactions.

(B) What is (are) the overall reaction(s) of this mechanism? (ignore trace reactants and by-products) (2 pts)

$$2\,O_3 \longrightarrow 3\,O_2$$ } +1 +1 For using propagation steps as labeled above. correct answer

(C) Sketch a propagation cycle for this chain reaction. (3 pts)



2pts. total if consistent with propagation steps above.
3pts. total if correct.
1pt. total if close to right answer but included 1-2 unnecessary species. Must have the correct cyclic reaction.