ORGOREVIEW

Question Vault

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In class we discussed the chlorination of methane. Here is an alternate mechanism.

Chain initiation

Step 1 $Cl_2 \longrightarrow 2Cl$ $\Delta H = +243$ kJ mol^{-1}

Chain Propagation

Step 2 $CH_4 + Cl^{\bullet} \longrightarrow CH_3Cl + H$ $\Delta H = +88$ kJ mol^{-1}

Step 3 $H^{\bullet} + Cl_2 \longrightarrow HCl + Cl^{\bullet}$ $\Delta H = -189$ kJ mol^{-1}

Chain Termination

Step 4 $H^{\bullet} + H^{\bullet} \longrightarrow H_2$ $\Delta H = -436$ kJ mol^{-1}

Step 5 $H^{\bullet} + Cl^{\bullet} \longrightarrow HCl$ $\Delta H = -432$ kJ mol^{-1}

Step 6 $Cl^{\bullet} + Cl^{\bullet} \longrightarrow Cl_2$ $\Delta H = -243$ kJ mol^{-1}

Bond Energies

Cl-Cl	243 kJ mol^{-1}
H-H	436 kJ mol^{-1}
H_3C Cl	352 kJ mol^{-1}
H_3CH	440 kJ mol^{-1}

This mechanism is thought to be *incorrect*. What is the best reason for why it is incorrect?

- **(A)** Step 1, the chain initiation step, is highly endothermic.

- **(B)** Step 2, the first chain propagation step, is highly endothermic.
- **(C)** Step 3, the second chain propagation step, is highly exothermic.
- **(D)** Steps 4, 5, and 6, the chain termination steps are all highly exothermic.
- **(E)** The overall reaction is exothermic.

VIDEO SOLUTION

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How to Reach Us
Todd's Test Prep
2255 Glades Road
Suite 324A
Boca Raton, Florida 33431
E-mail: help@orgoreview.com

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