# 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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