

Free-Radical Chlorination Mechanism Explained

<https://gemini.google.com/app/bea064ef0ea6a0bd>

Response: The correct answer is **(5)**.

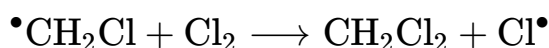
Explanation

In the free-radical chlorination mechanism of methane:

- **Option (1)** is the **Initiation** step, where ultraviolet light ($h\nu$) causes homolytic cleavage of the $\text{Cl}-\text{Cl}$ bond to form two chlorine radicals ($\text{Cl}^\bullet$).
- **Options (2) & (3)** are the standard **Propagation** steps that yield chloromethane (CH_3Cl) and regenerate a chlorine radical ($\text{Cl}^\bullet$).
- **Option (4)** is a subsequent **Propagation** step where a chlorine radical abstracts a hydrogen atom from chloromethane (CH_3Cl) to form a chloromethyl radical ($^\bullet\text{CH}_2\text{Cl}$).

Why (5) is incorrect:

To produce dichloromethane (CH_2Cl_2), the chloromethyl radical ($^\bullet\text{CH}_2\text{Cl}$) must react with a chlorine molecule (Cl_2), not hydrogen chloride (HCl):



Free hydrogen radicals ($\text{H}^\bullet$) are **not** generated during free-radical halogenation due to the high bond energy involved.
