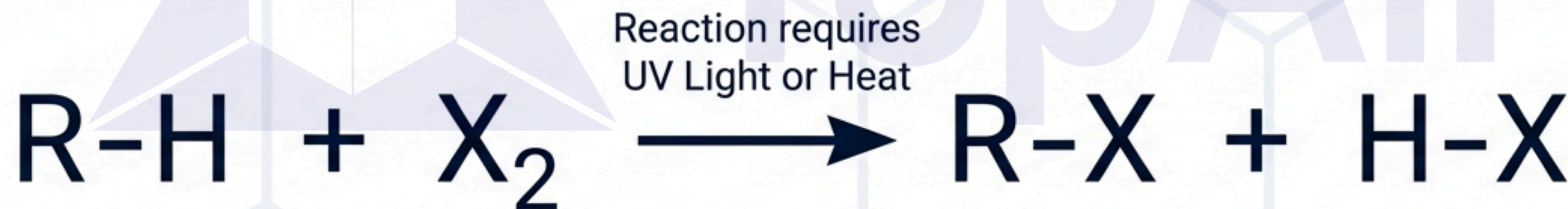


Free Radical Halogenation

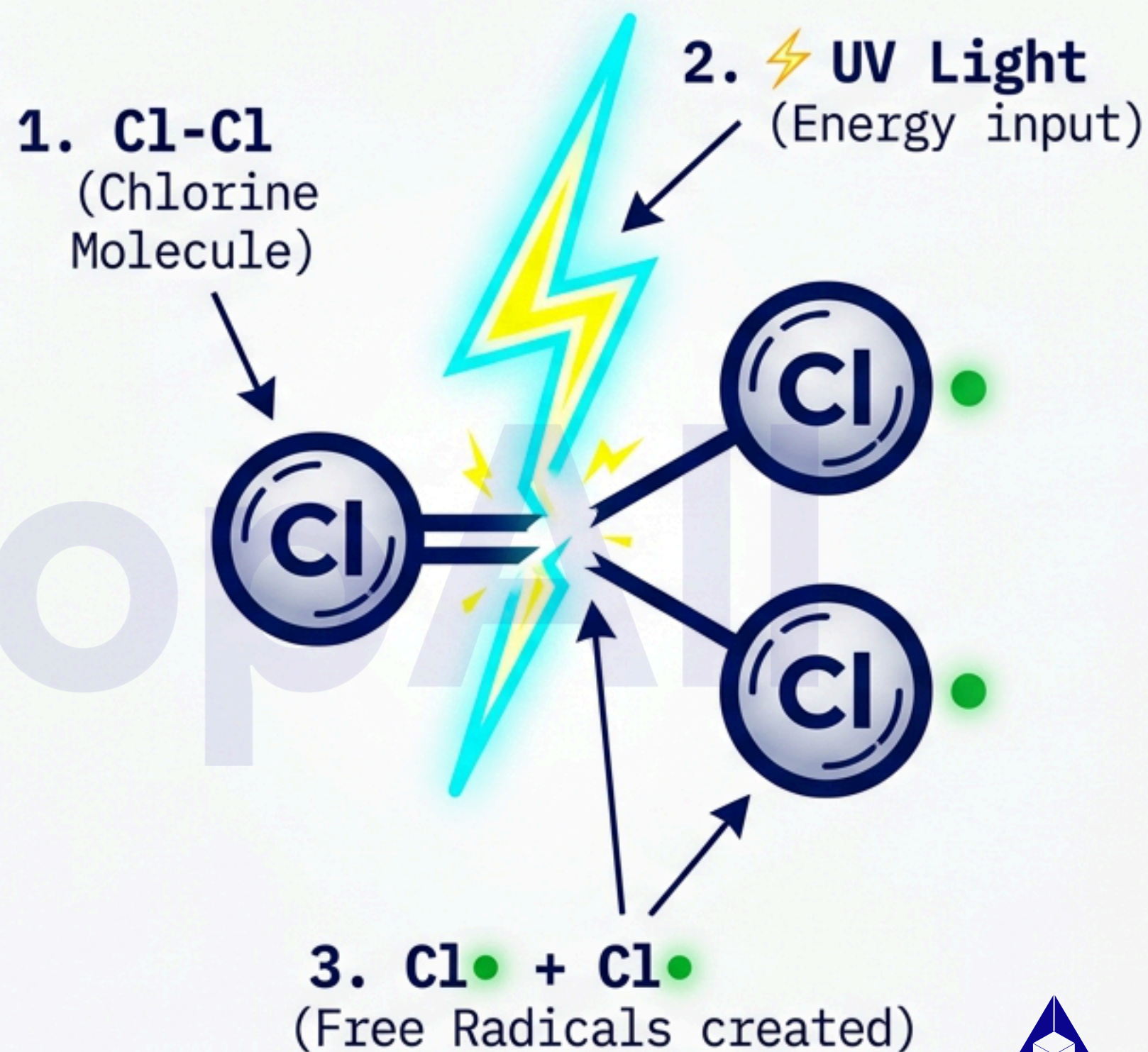
Preparation of Haloalkanes from Alkanes



The Catalyst: UV Light or Heat

Alkanes are generally unreactive, but they can be forced to react with halogens (like Chlorine or Bromine).

This reaction is triggered by highly energetic conditions: either Ultraviolet (UV) light or extreme heat.



The Problem with Free Radicals

Why Mixtures Form



Uncontrolled Reaction

Free radicals are highly reactive and do not stop after replacing just one hydrogen atom.



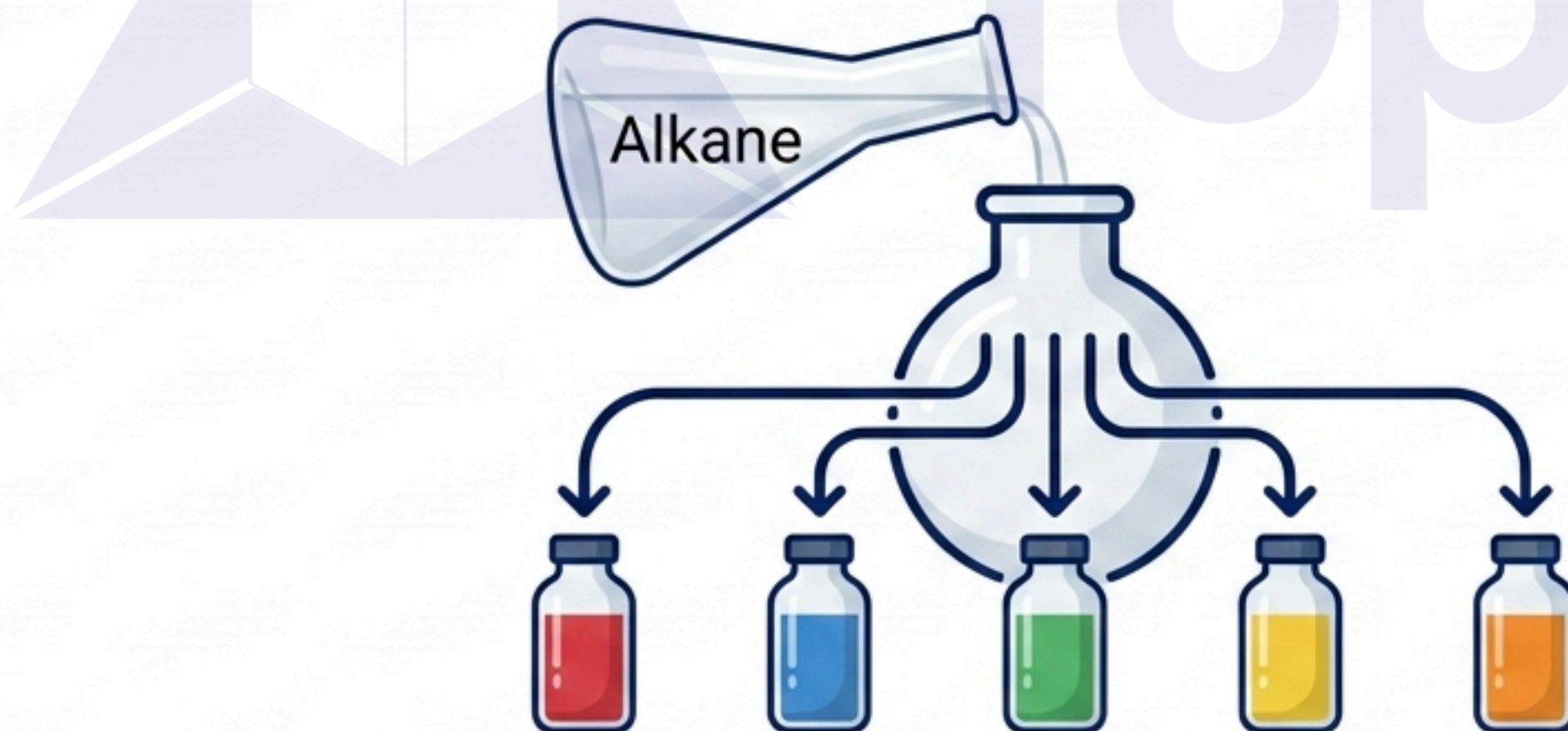
Chain Substitution

They continue reacting, leading to both mono-haloalkanes and poly-haloalkanes.



Complex Mixture

The result is a chaotic flask containing multiple isomeric variations of the substituted alkane.





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$$E=mc^2$$



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Reaction Limitations

Laboratory Challenge

The yield of any single pure compound is extremely low.

Because the reaction produces a complex mixture of isomers...



...it is incredibly difficult to separate them into pure compounds.



Conclusion: Free radical halogenation is rarely used in labs to synthesize one specific, pure alkyl halide.

Exam Focus: Monohalogen Products



Despite the reality of complex mixtures, exams focus on predicting the first step of this reaction.

You will frequently be asked to identify all possible structural isomers if only ONE halogen atom is substituted (Monohalogenation).

The Goal

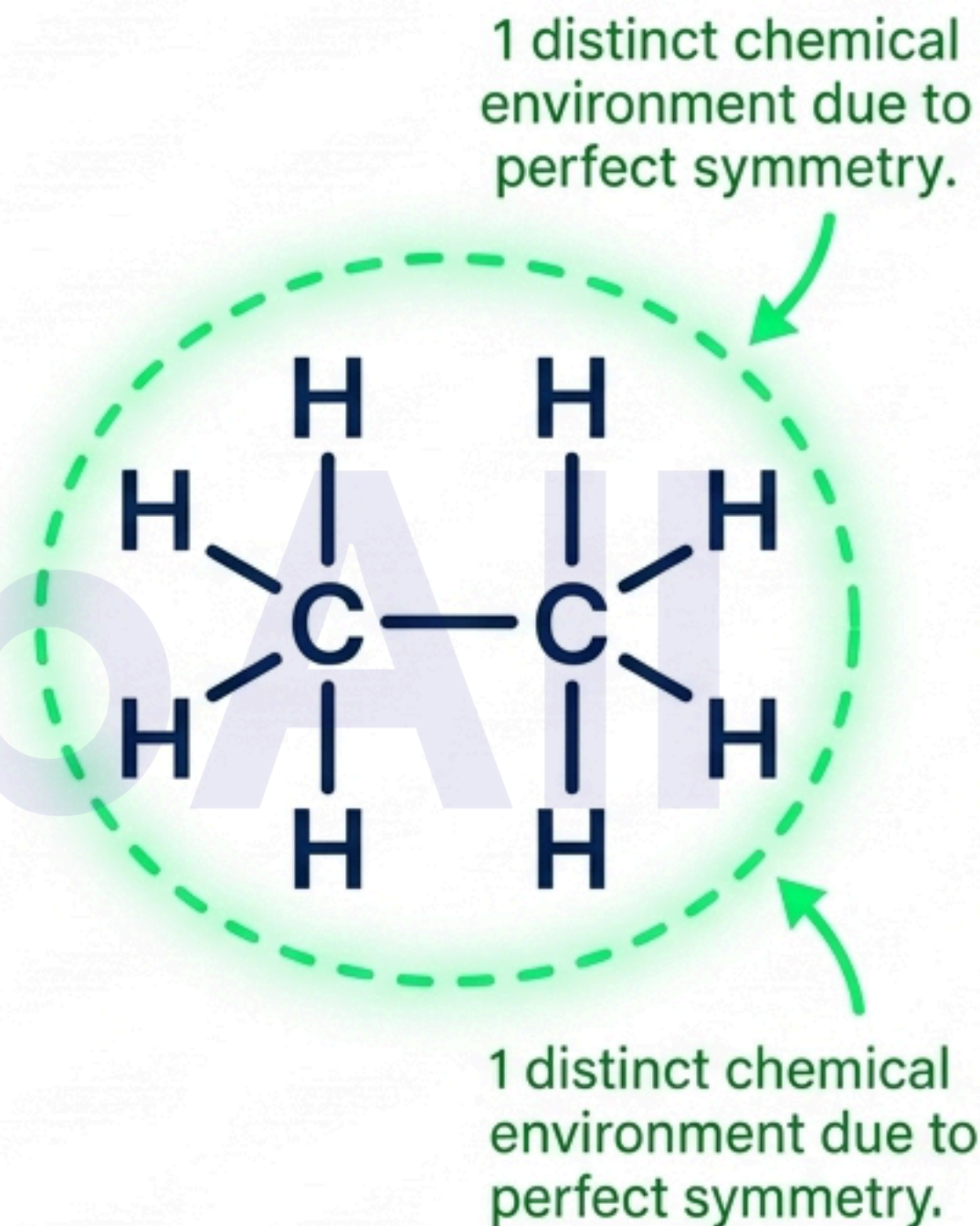
Predict all possible single-substitution products before polyhalogenation occurs.

Key Concept

The Golden Exam Rule

Count the Different Hydrogen Types.

The number of distinct monohalogen structural isomers formed equals the number of structurally distinct (non-equivalent) hydrogen environments in the parent alkane.



Example 6.3: Monochlorination of 2-Methylbutane

Identify all 4 different types of Hydrogen atoms (a, b, c, d).



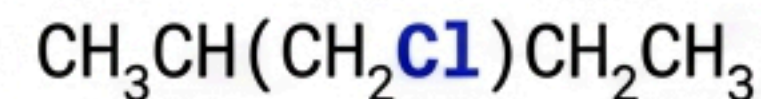
1-chloro-3-methylbutane



2-chloro-3-methylbutane



2-chloro-2-methylbutane



1-chloro-2-methylbutane



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