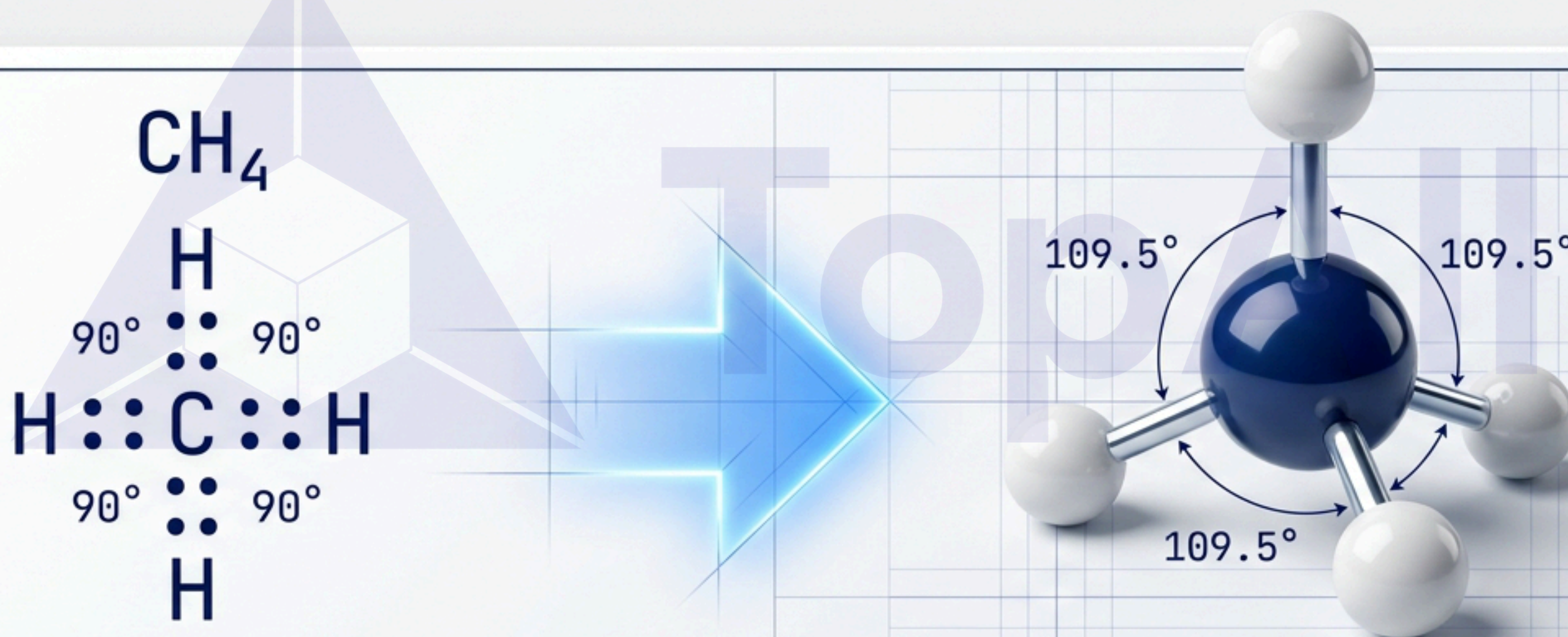


4.4 VSEPR Theory

Transitioning from 2D Lewis structures to 3D molecular architecture.

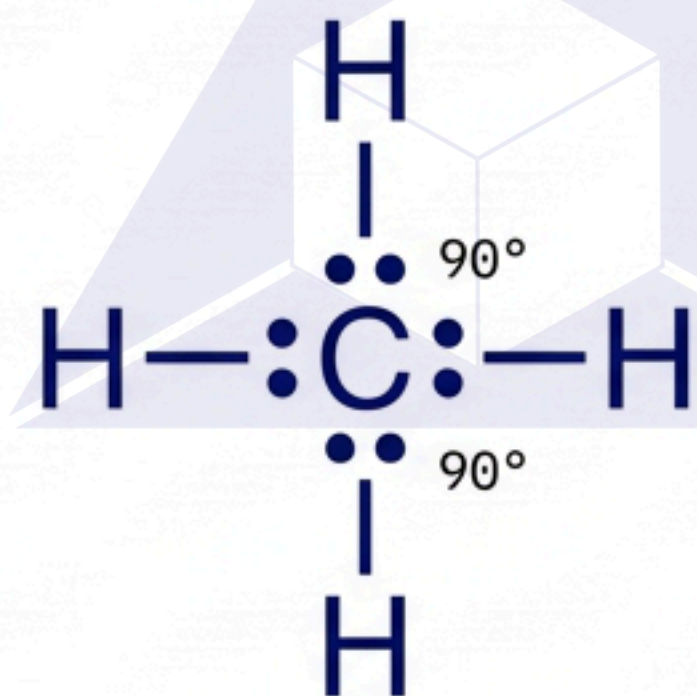


Valence Shell Electron Pair Repulsion Theory

THE LIMITATION

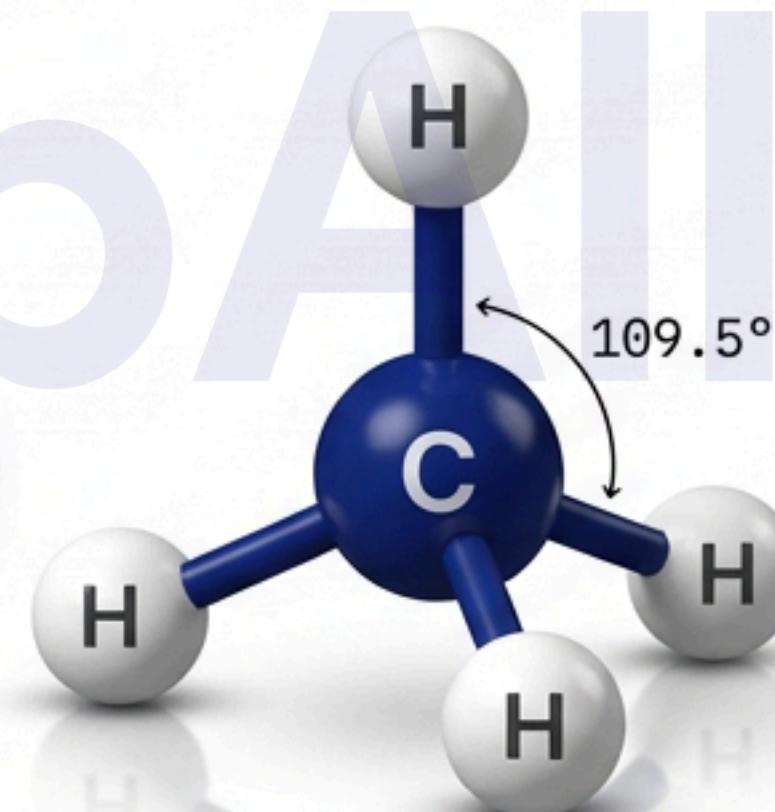
Why Lewis Structures Are Not Enough

Lewis concept provides 2D electron accounting but is completely unable to explain the physical 3D shapes of molecules.



Theoretical 2D Lewis Model (90°)

How do we bridge the gap? → **VSEPR**



Actual 3D Physical Shape (109.5°)

Core Postulates of VSEPR

Developed by Sidgwick & Powell (1940) and refined by Nyholm & Gillespie (1957).

[DOMAINS DICTATE SHAPE]

The shape of a molecule depends on the total number of **valence shell electron pairs (bonded + nonbonded)** around the central atom.

[MAXIMIZE DISTANCE]

Electron pairs are negatively charged clouds that **repel each other**. They localize on a **spherical surface** to maximize distance and minimize repulsion.

[SUPER PAIRS]

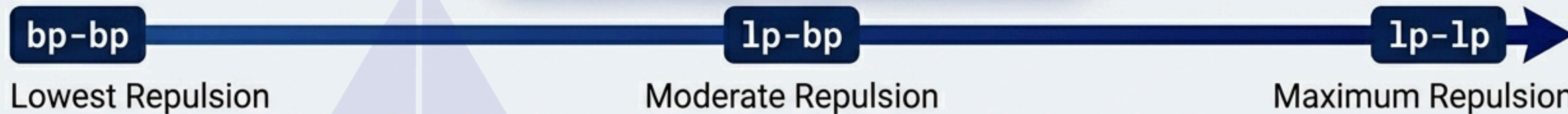
A multiple bond (double/triple) is treated as if it were a single electron pair (a super pair).

THE MECHANISM

Repulsion Order

$$1p-1p > 1p-bp > bp-bp$$

Force Spectrum

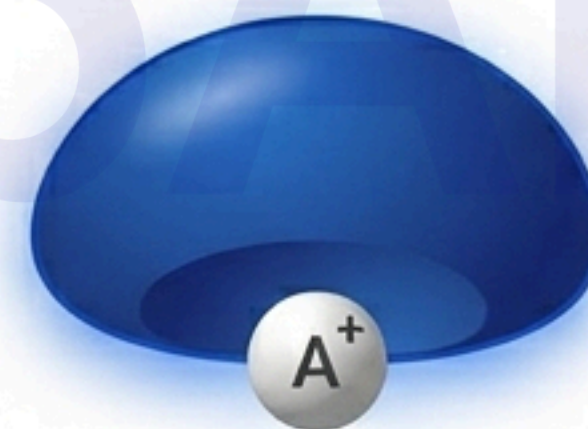


Side A



Shared between two atoms
= tightly constrained.

Side B



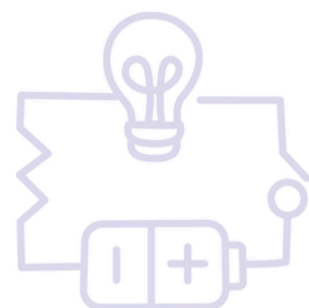
Lone Pair

Attracted to only one nucleus =
spreads out and hogs spatial volume.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

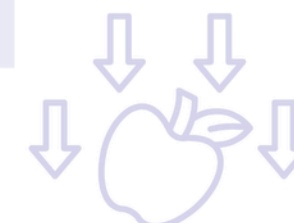
Practice Now



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Key Highlights

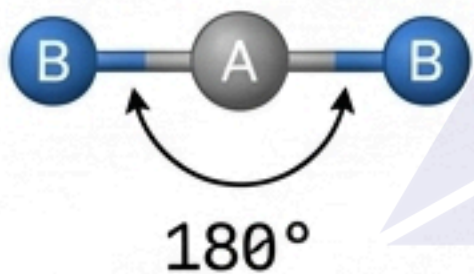
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Shapes with No Lone Pair

AB2

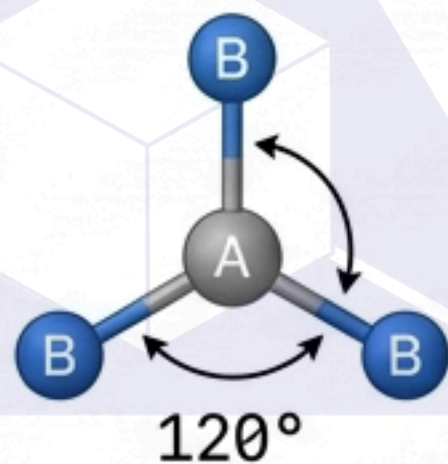
Linear



BeCl2

AB3

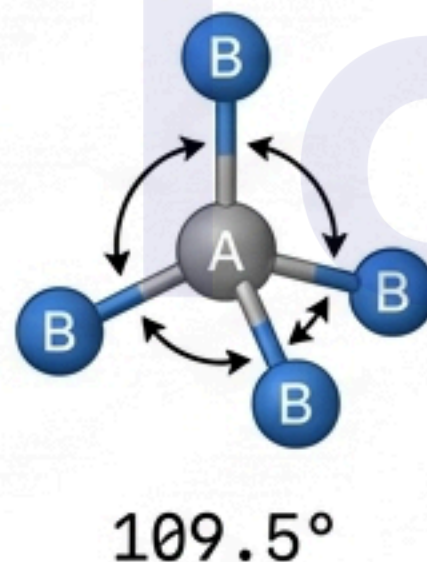
Trigonal Planar



BCl3

AB4

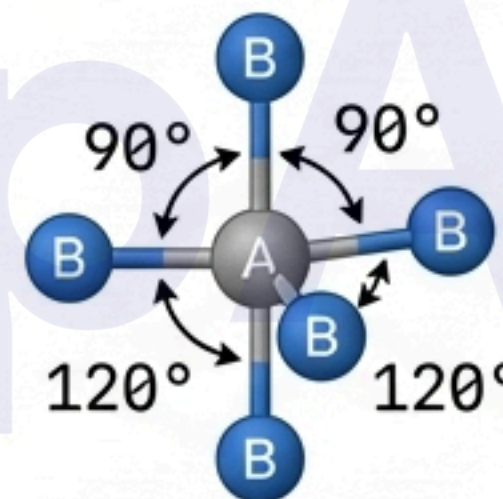
Tetrahedral



CH4

AB5

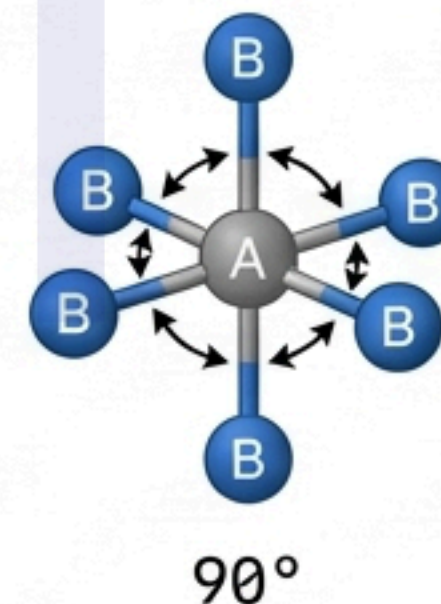
Trigonal Bipyramidal



PCl5

AB6

Octahedral



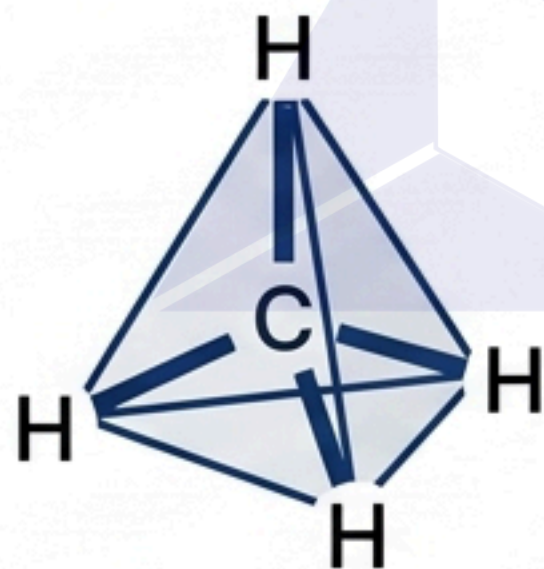
SF6

Shapes with Lone Pair(s)

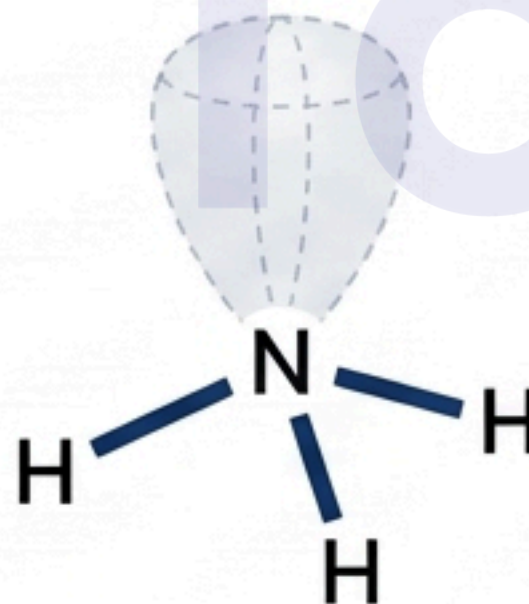
The electron geometry remains constant, but the molecular geometry changes.

AB₄

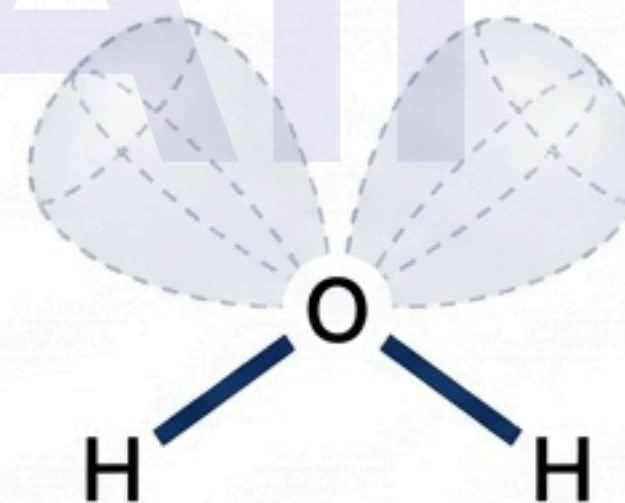
CH₄
Tetrahedral

**AB₃E₁**

NH₃
Trigonal Pyramidal

**AB₂E₂**

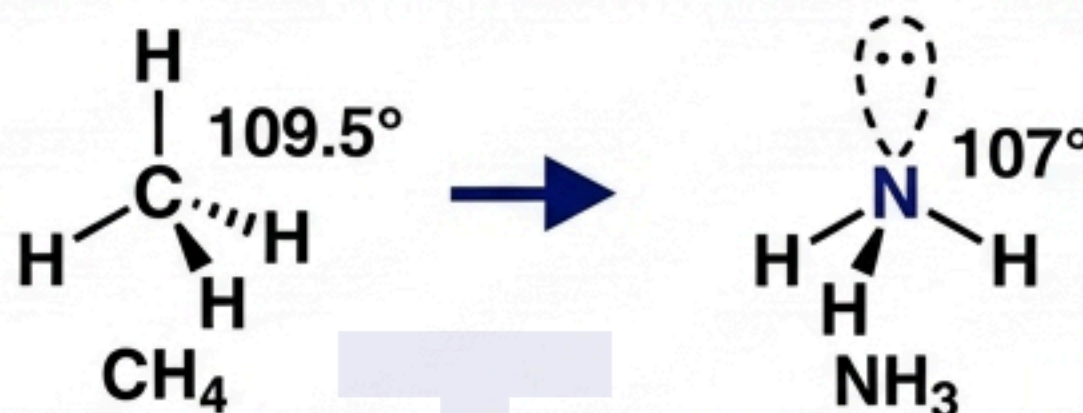
H₂O
Bent / V-shape



Lone pairs act as invisible structural forces shaping the visible molecule.

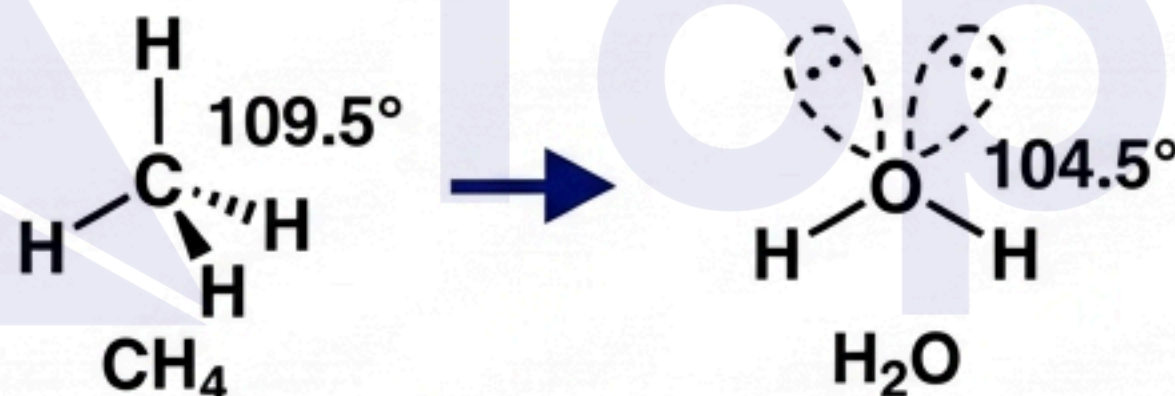
Distortion Logic

The Squeeze (AB₃E₁)



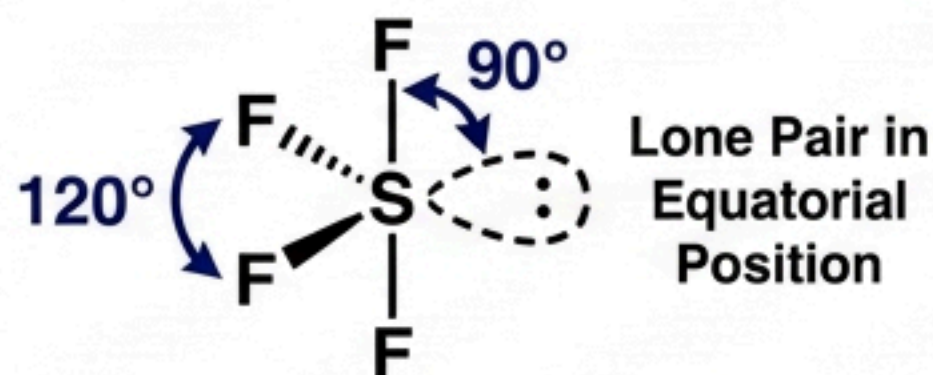
lp-bp repulsion > bp-bp repulsion pushes bonds closer.

The Double Squeeze (AB₂E₂)



lp-lp repulsion dominates, severely reducing bond angle.

Equatorial Preference (AB₄E₁)



Lone pairs seek equatorial positions to minimize punishing 90° repulsions.

Final Recap

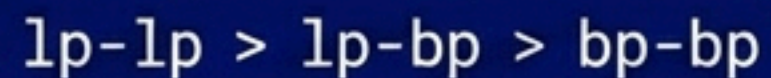
[Total Electron Domains] + [Minimization of Repulsion] = [3D Molecular Shape]

The Goal

Bonding is nature's way of lowering energy. Shape is simply a physical manifestation of minimizing electrostatic repulsion.

The Hierarchy

Never forget the golden rule:



The Invisible Architects

Lone pairs might not be visible when naming a molecular shape, but they dictate the entire structure.



You've Learned the Theory.

Now Let's Test It.

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