

The Bracket Barrier: Defining Ionisation Isomerism

Coordination Sphere



Ionisation Sphere

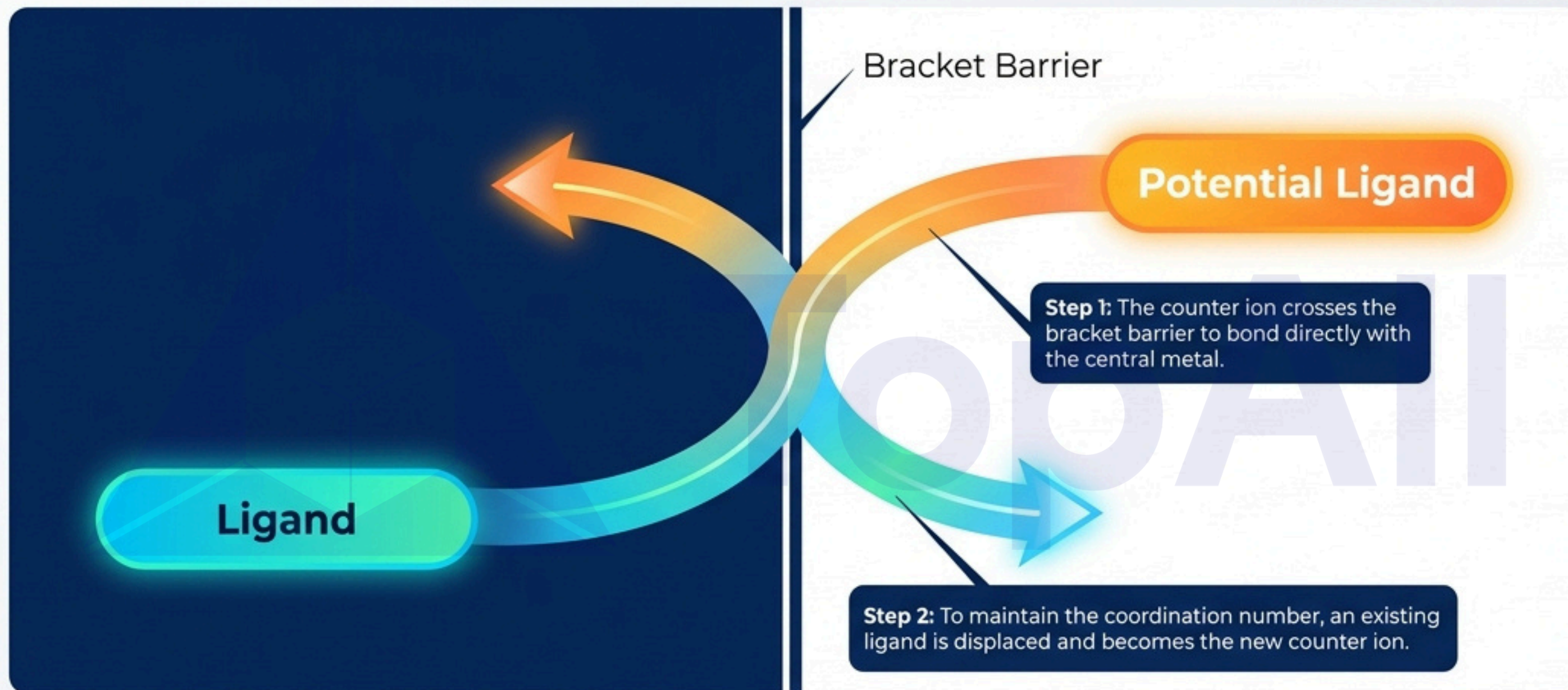
Counter Ion

Definition: Ionisation isomerism arises when a counter ion in a complex salt is itself a potential ligand.

The Core Rule: Compounds with the exact same chemical formula can produce entirely different ions in solution depending on which molecules are trapped inside the bracket versus free-floating outside it.

THE MECHANISM

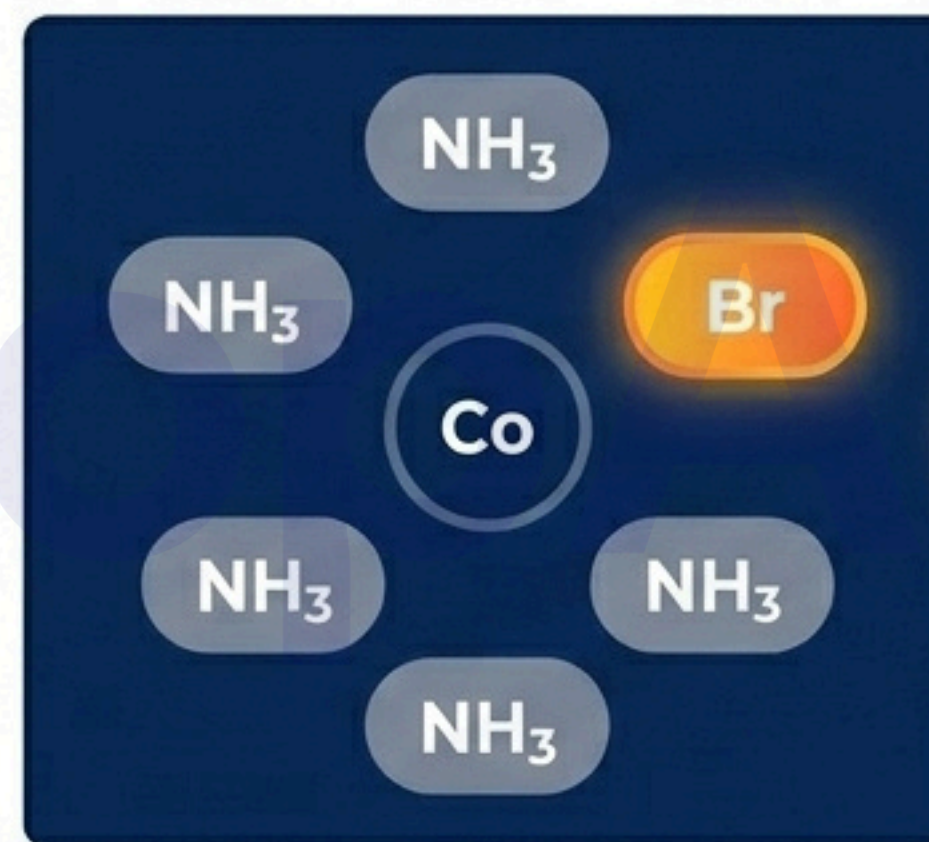
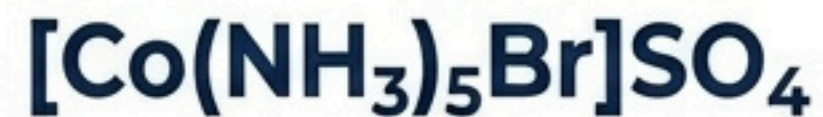
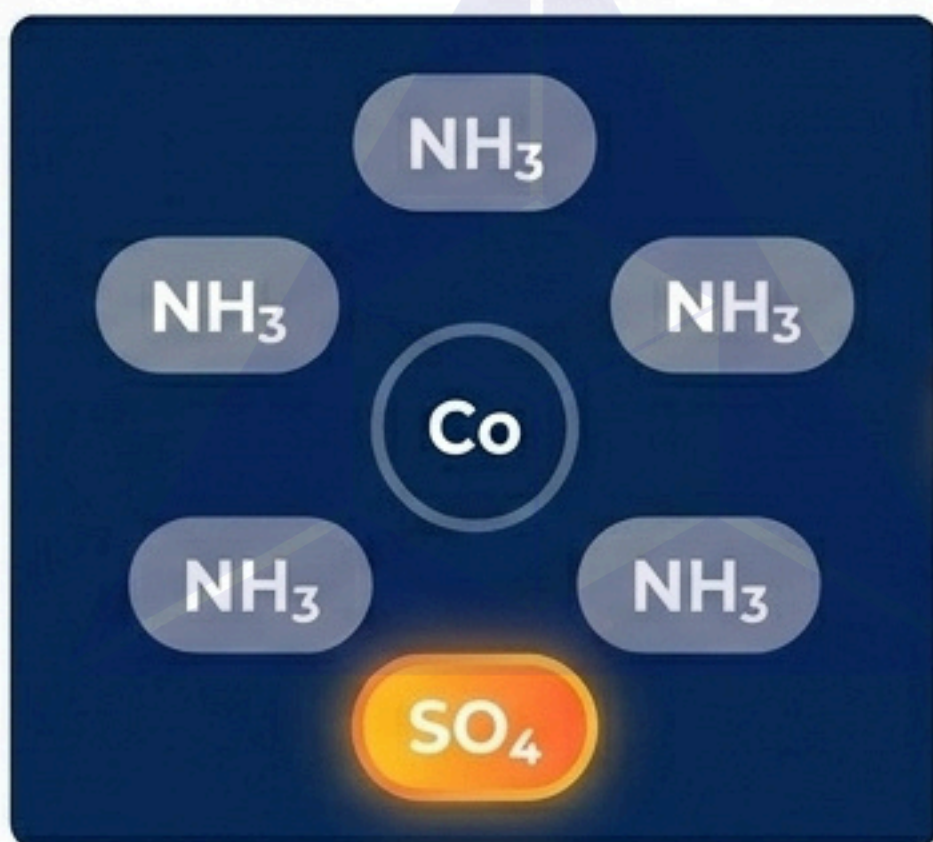
The Counter Ion Becomes a Ligand



Result: The molecular formula remains identical, but the spatial arrangement—and the resulting chemical properties—are fundamentally transformed.

MOLECULAR COMPARISON

A Case Study in Cobalt Isomers



Notice the static core: Both isomers contain one Cobalt atom and five Ammonia molecules. The only difference is the physical location of the Sulphate and Bromide groups.



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$$E=mc^2$$



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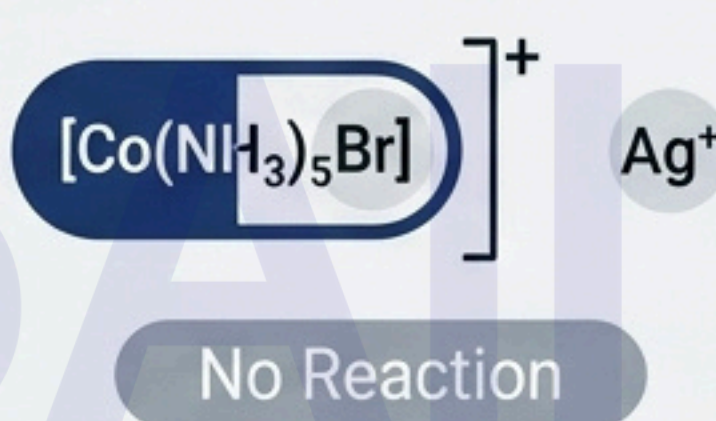
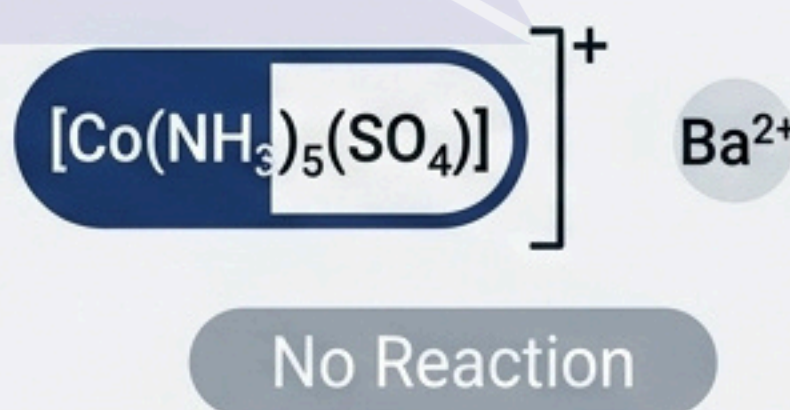
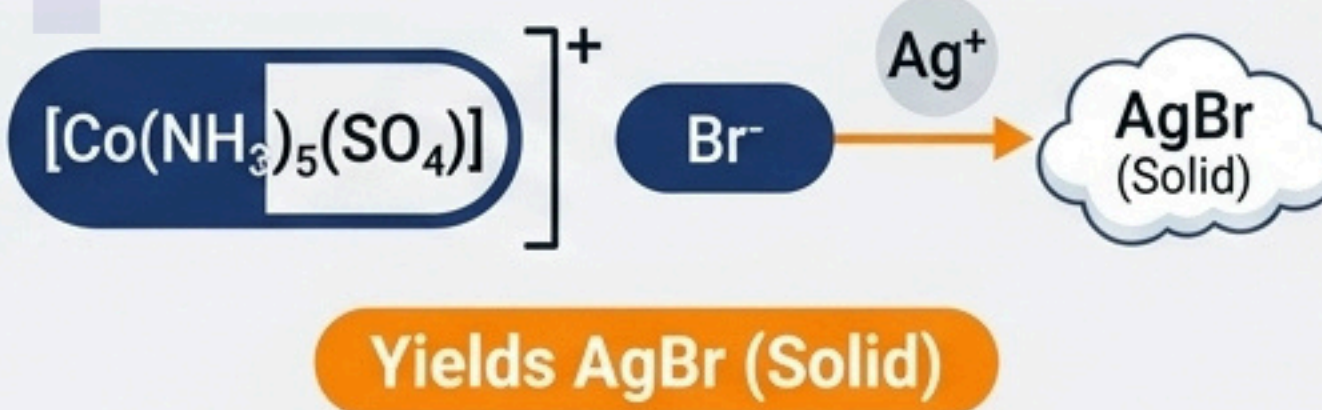
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The Diagnostic Test Matrix: Proof in Solution

	 Add Barium (Ba^{2+})	 Add Silver (Ag^+)
$[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$	 Yields BaSO_4 (Solid)	 No Reaction
$[\text{Co}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$	 No Reaction	 Yields AgBr (Solid)

Reagents act as chemical lie detectors. They can only react with ions swimming free in the solution, completely ignoring groups trapped inside the coordination sphere.



Same Formula, Different Ions

Ionisation isomers share identical empirical formulas but dissolve in water to yield completely different ions.



The Swap

Isomerism occurs when an outer counter ion displaces an inner ligand, swapping places across the coordination boundary.



Diagnostic Detection

Because the coordination sphere (bracket) does not dissociate, we can use precipitation tests like Silver or Barium to reveal exactly which ion is trapped inside and which is free outside.



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