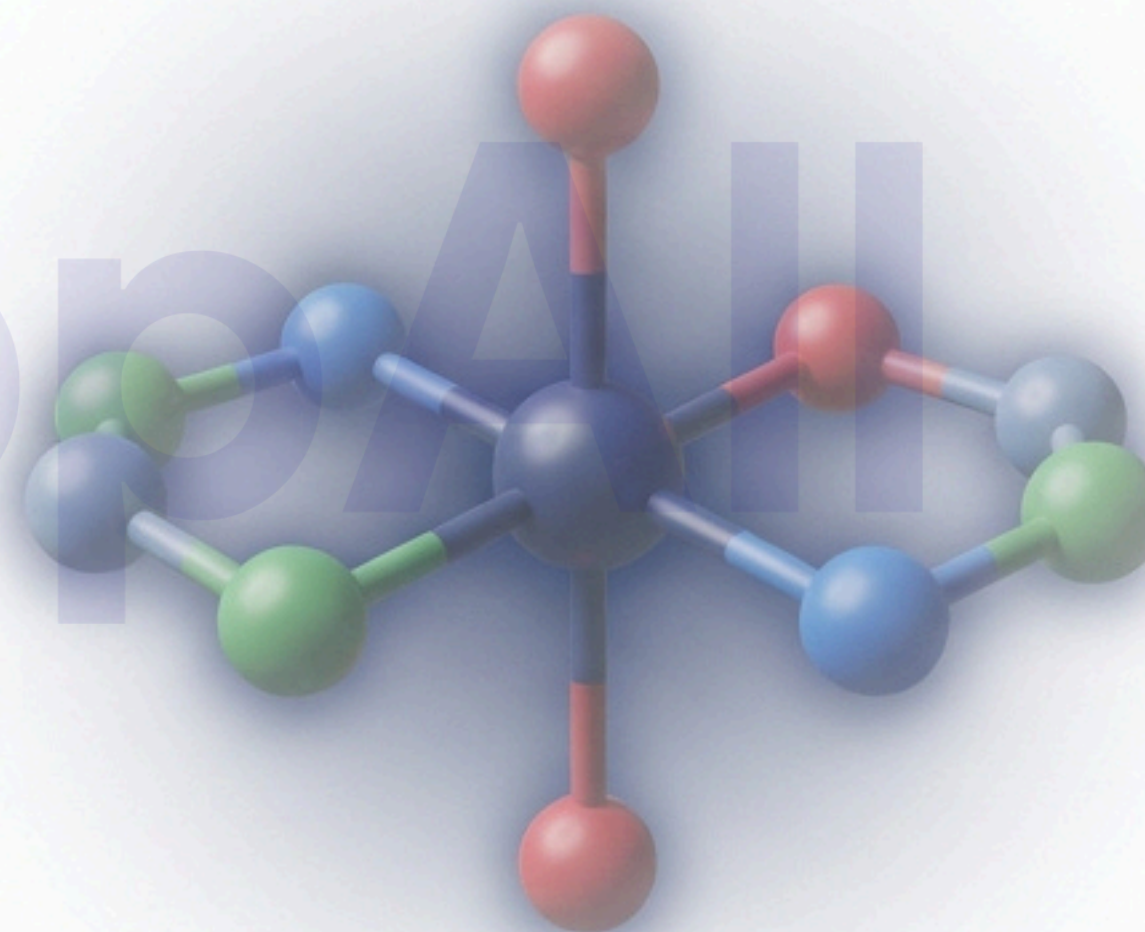
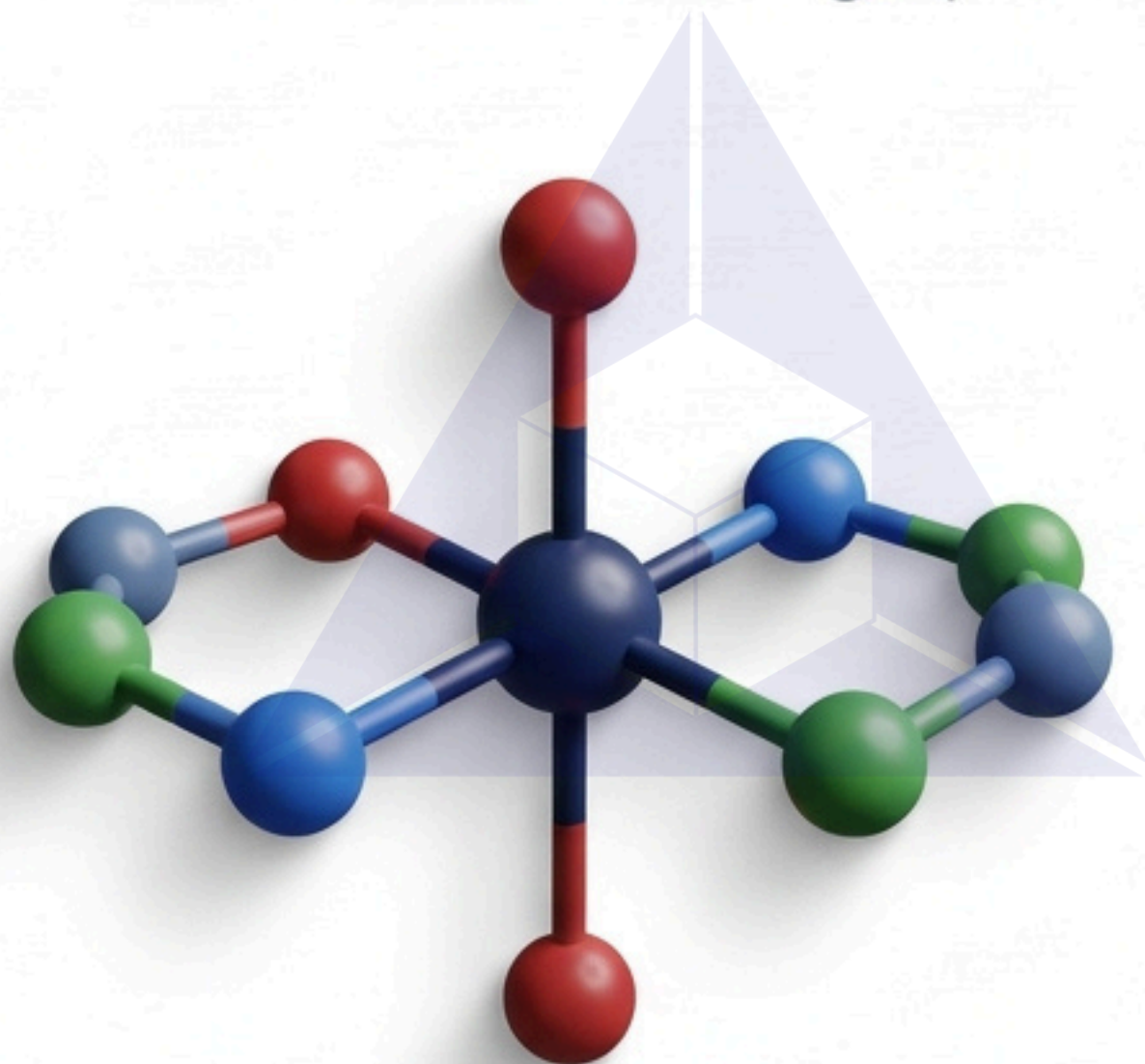


# The Chemistry of the Mirror Realm

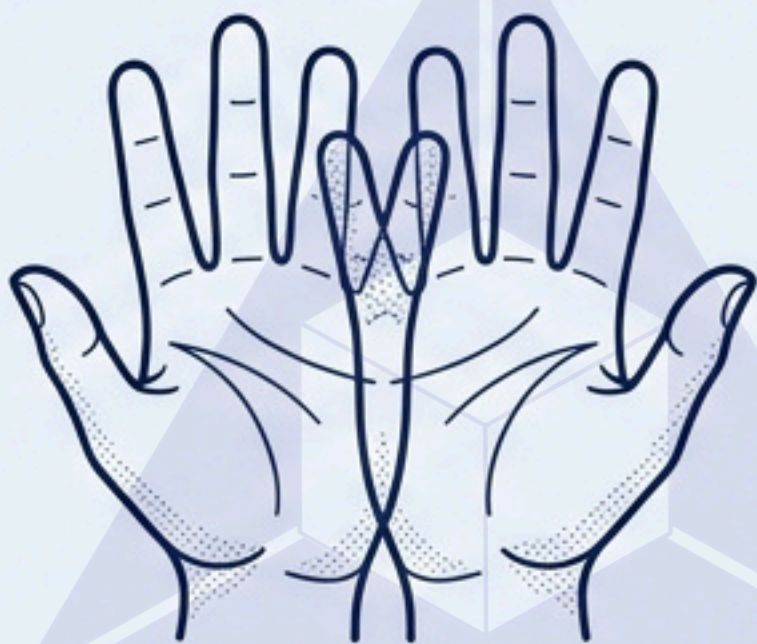
Understanding Optical Isomerism in Coordination Compounds



7-Part Visual Guide

The Tangible World

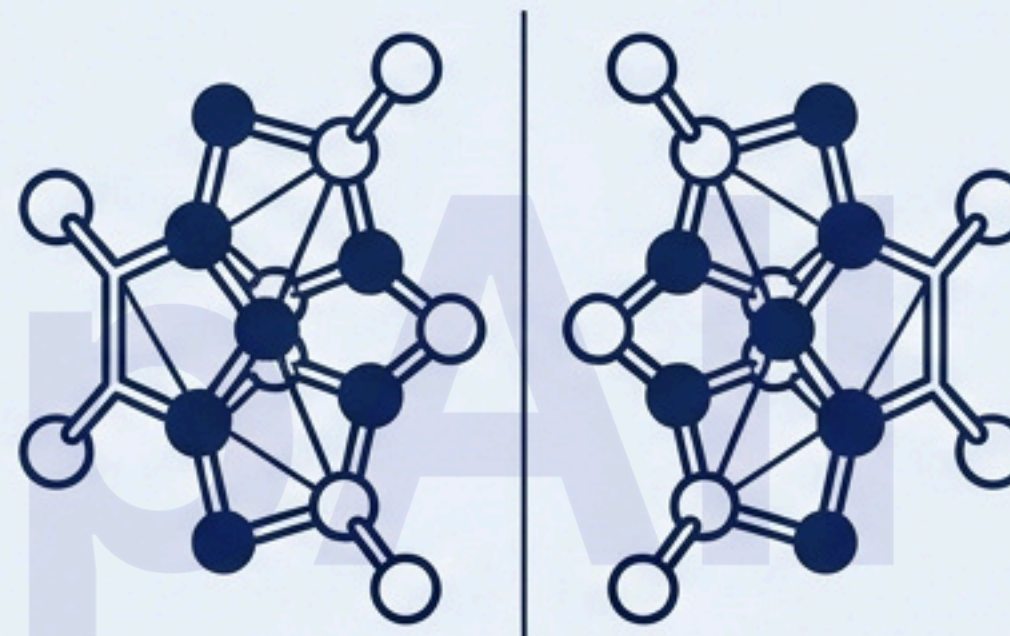
## The Concept of Chirality



Your left and right hands are mirror images of each other, but they cannot be perfectly overlapped. In science, objects with this property are called **chiral**.

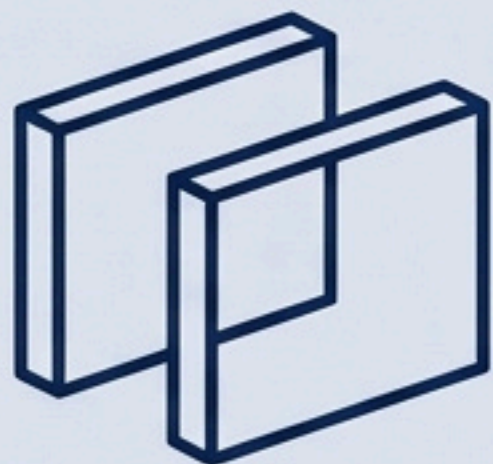
The Chemical World

## Molecules Can Be Hands, Too



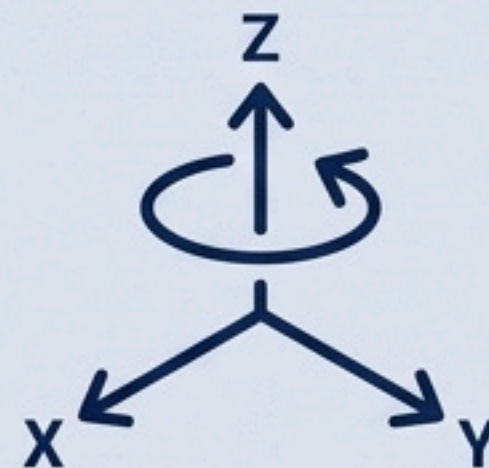
When a coordination entity forms a mirror image that cannot be superimposed on the original molecule, it exhibits **optical isomerism**. They look identical but behave differently in 3D space.

# The Optical Isomerism Lexicon



## Enantiomers

The official term for the two optical isomers. They are identical in formula and bonds, but are **non-superimposable mirror images**.



## Chiral

The defining property of these molecules. If an ion cannot be superimposed on its mirror image, it is chiral.



## Dextro (d)

From Latin dexter (right). This form rotates the plane of polarized light to the **right**.



## Laevo (l)

From Latin laevus (left). This enantiomer rotates the plane of polarized light to the **left**.



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

$$E=mc^2$$



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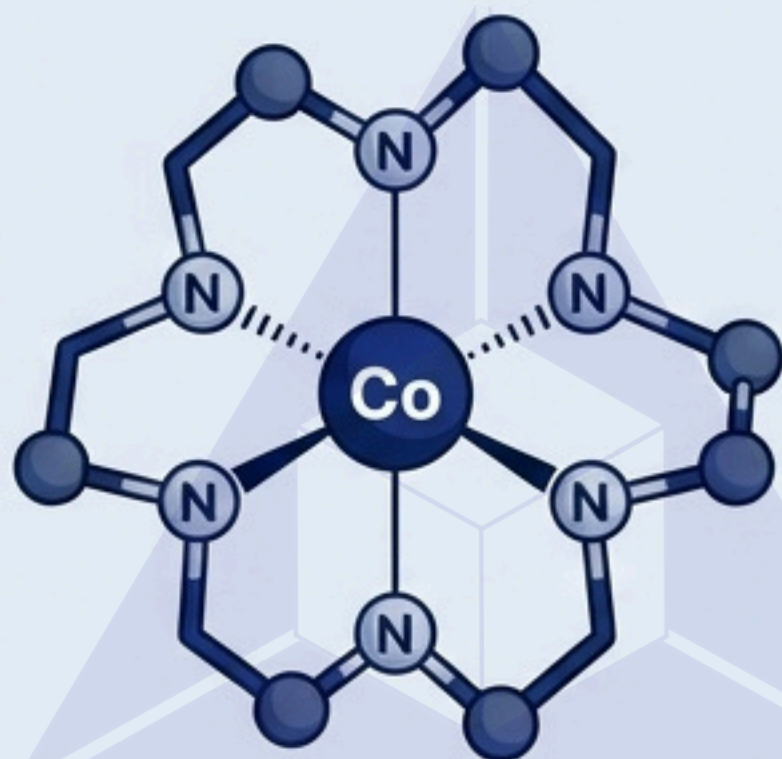
At [prep.topall.app](https://prep.topall.app)

## Key Highlights

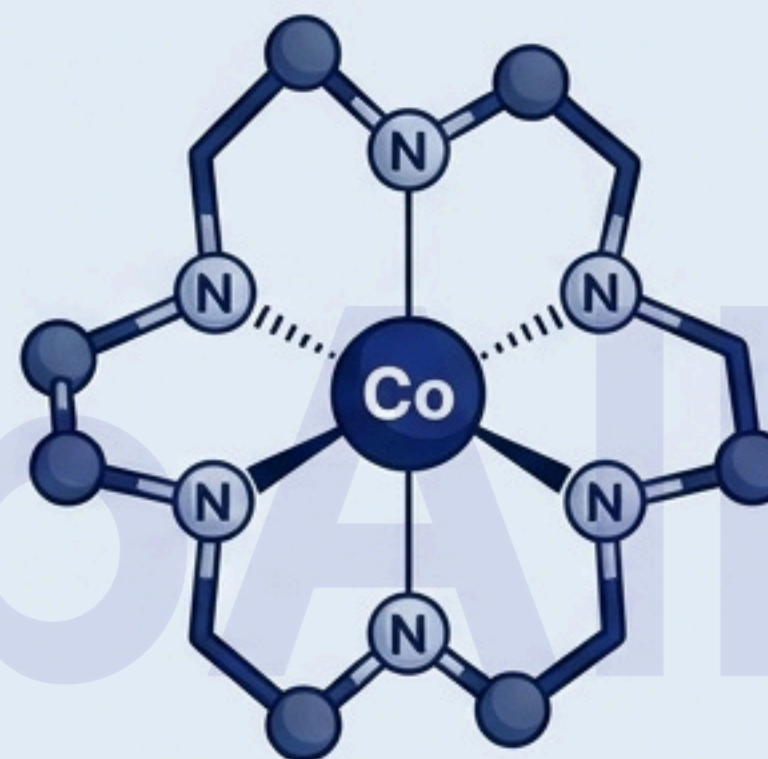
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# Optical Isomerism in Homoleptic Complexes



**d-form (Dextro)**

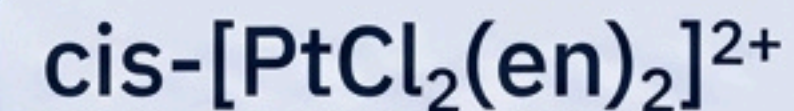


**l-form (Laevo)**

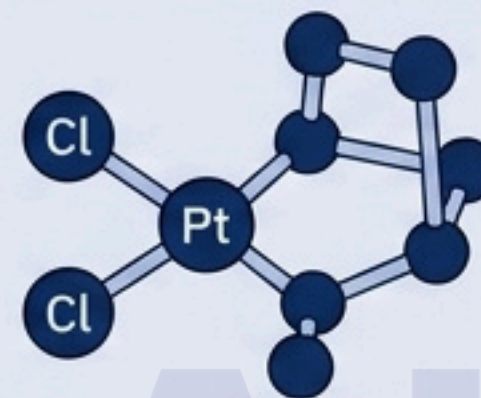
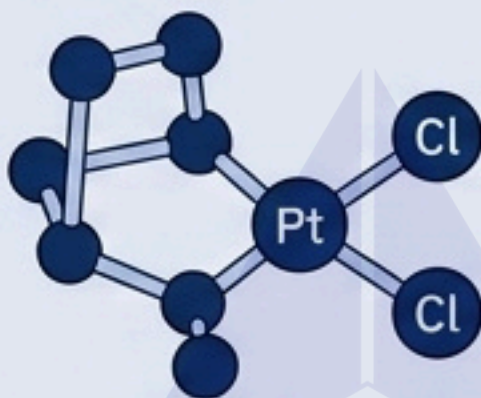


Optical isomerism is extremely common in octahedral complexes involving didentate ligands (like en). The three bidentate ligands create a propeller-like twist that is inherently chiral.

# The Cis Caveat in Heteroleptic Complexes

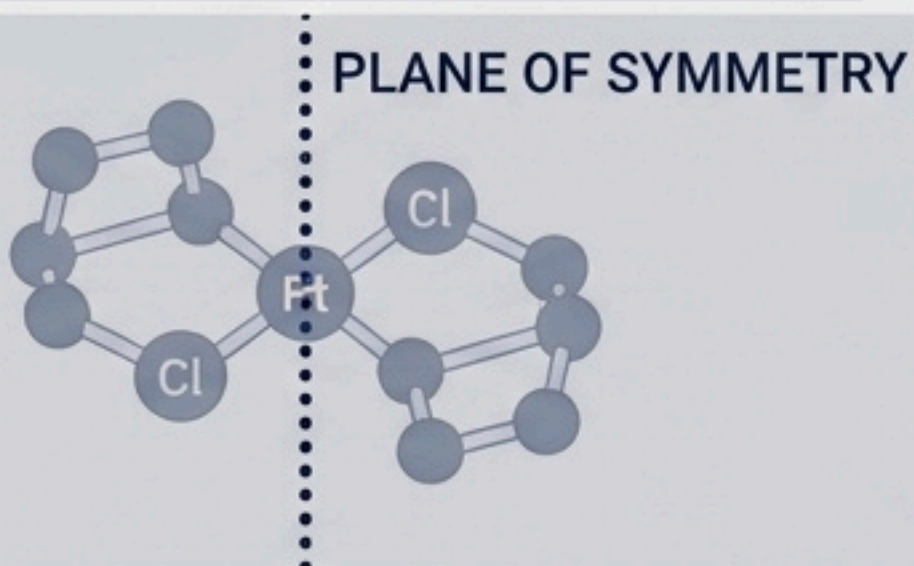


## The Optically Active Forms



The *d* and *l* enantiomers of the *cis*-isomer are non-superimposable.

## The Inactive Exception



### ! Why not *trans*?

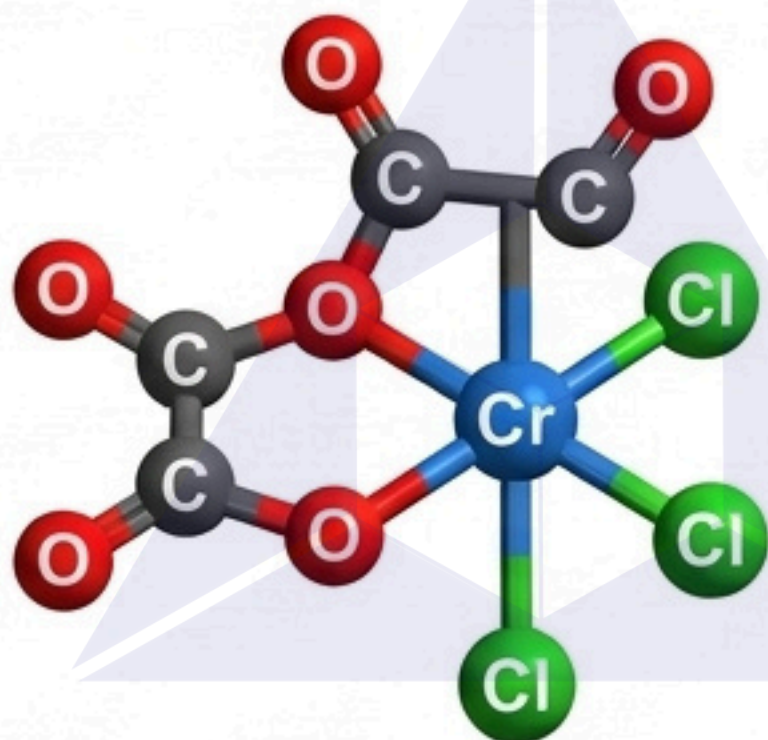
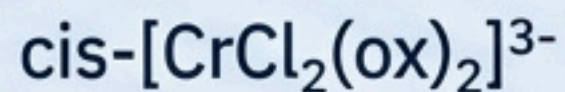
The *trans*-isomer possesses a plane of symmetry. Its mirror image is perfectly superimposable on itself, meaning it is achiral and optically inactive.

## Key Takeaways: Spotting Optical Isomers

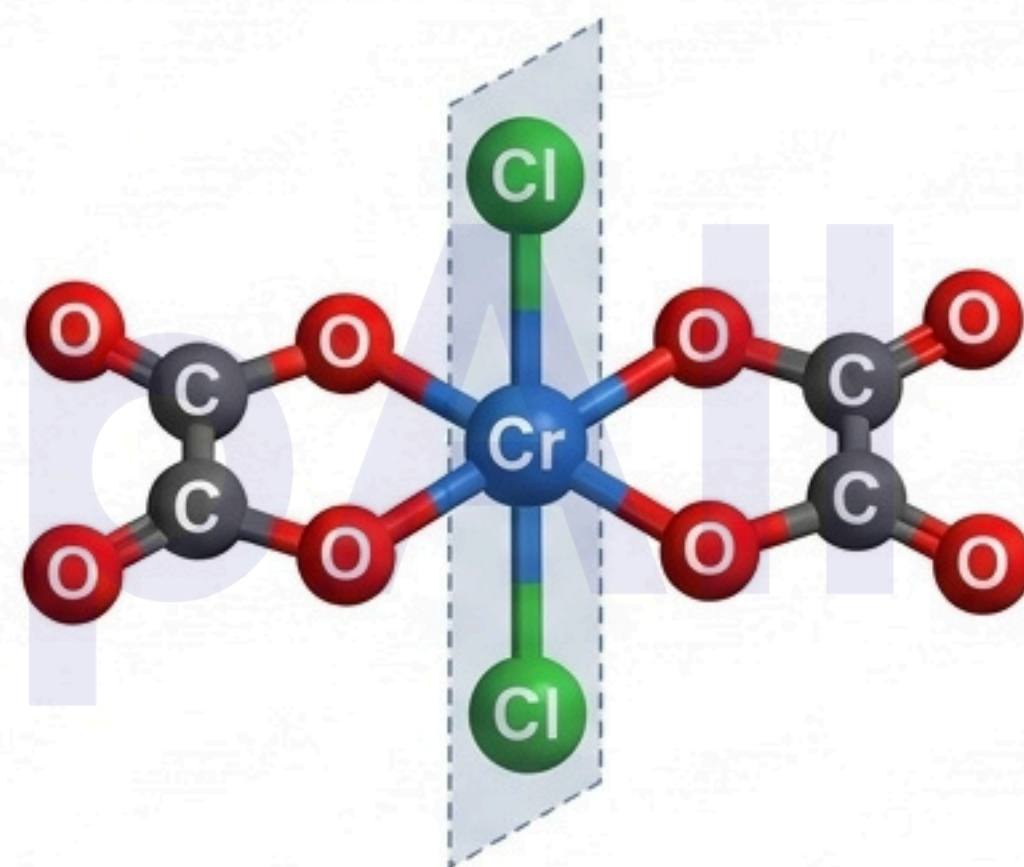
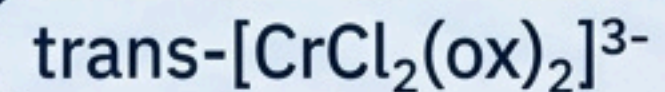
- ✓ **Octahedral Dominance:** Optical isomerism is most commonly found in coordination entities with an octahedral geometry (Coordination Number = 6).
- ✓ **Didentate is Key:** The presence of didentate ligands (like en or ox) is the strongest indicator that a complex might be chiral.
- ✓ **Cis Over Trans:** For complexes of the type  $[MX_2L_2]$ , only the cis-isomer will show optical activity. The trans-isomer's internal symmetry prevents chirality.
- ✓ **Physical Properties:** Enantiomers share identical physical properties, except for the direction they rotate polarized light (d vs l).

# Knowledge Check: Which is Optically Active?

Out of the following two coordination entities, which one is chiral?



✓ Optically Active (Chiral)



✗ Optically Inactive (Achiral)

As we established, only the cis form lacks a plane of symmetry. The trans form is superimposable on its mirror image.



# You've Learned the Theory.

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