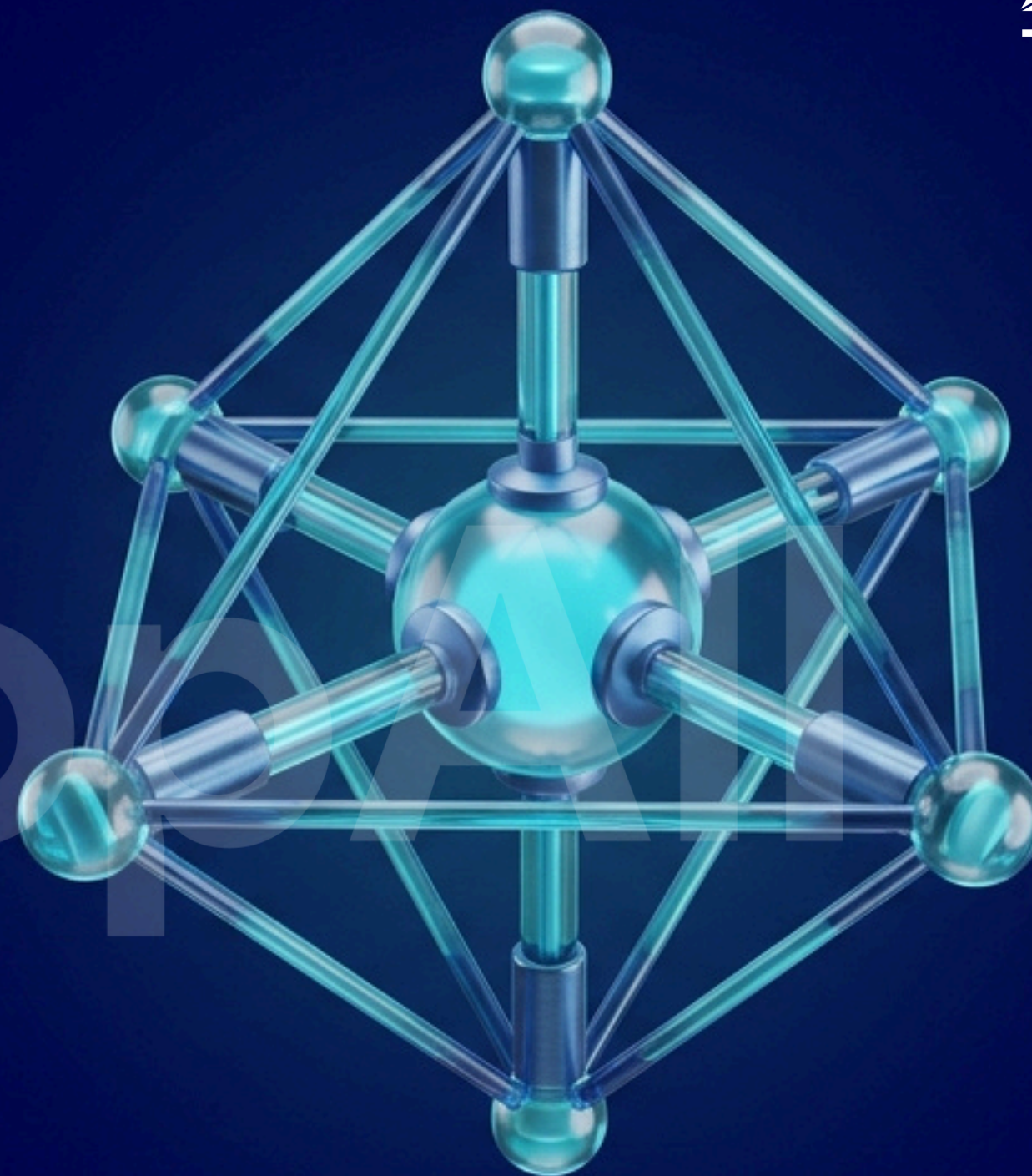


UNIT 5 • COORDINATION COMPOUNDS

IUPAC Nomenclature of Mononuclear Coordination Compounds

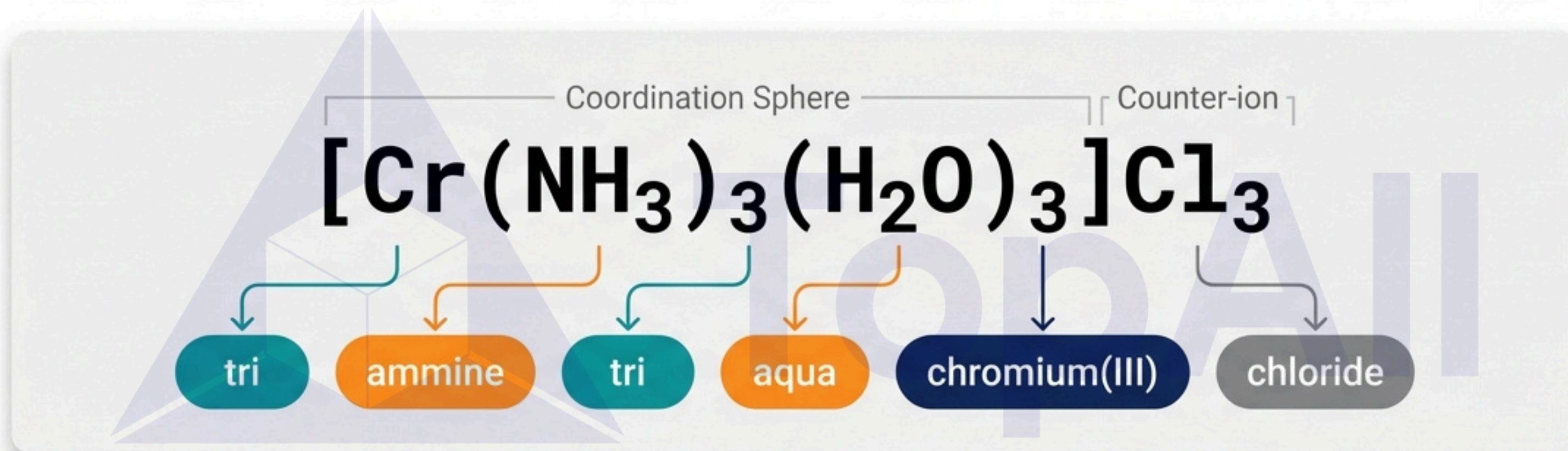
The universal grammar for naming
transition metal complexes.



Mastering the rules of chemical syntax.

Deconstructing the Syntax

Every coordination compound name follows a strict grammatical structure. The cation is always named before the anion.



Alphabetical Rule: ammine comes before aqua.

Spacing Rule: Notice the coordination sphere is written as one unbroken word. A single space separates it from the counter-ion.

Naming the Ligands

Ligands are named before the central metal, arranged in strict alphabetical order regardless of their charge.

Anionic Ligands

Anionic ligands drop their standard suffix and end in -o or -ido.



chlorido



cyanido



oxalato

Neutral Exceptions

Most neutral ligands keep their standard molecule name, with four critical IUPAC exceptions.



aqua



ammine



carbonyl



nitrosyl

ⓘ Note the double 'm' in ammine!

Indicating Quantity: Multiplier Prefixes

The number of identical ligands is indicated by prefix modifiers. The specific prefix depends on the complexity of the ligand itself.

Simple Ligands

Use for monoatomic or simple ligands.

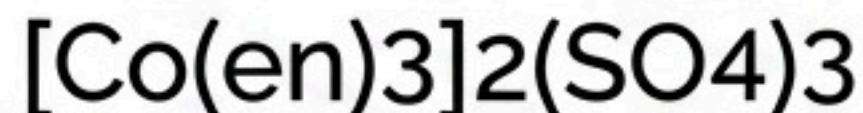
di-
tri-
tetra-
penta-
hexa-

Complex Ligands

Use for polydentate ligands or ligands that already contain a numerical prefix. Enclose the ligand name in ().

bis-
tris-
tetrakis-

Anchor Example



Because 'en' (ethane-1,2-diamine) already contains a number, we must use the complex multiplier 'tris'.

tris (ethane-1,2-diamine) cobalt(III) sulphate



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Naming the Central Metal

The metal's name transforms based on the overall charge of its coordination sphere.
Oxidation states are always written in Roman numerals ().



The Cation Context



Diagnosis

The sphere has a positive charge. The metal keeps its normal elemental name.

diamminesilver(I)

The Anion Context



Diagnosis

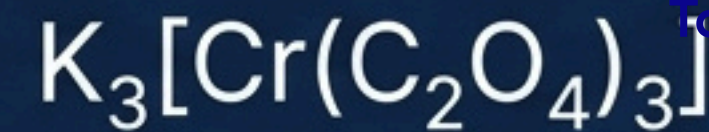
The sphere has a negative charge. The metal takes the -ate suffix (and Latin root).

dicyanidoargentate(I)

Notice how the name of the metal differs in cation and anion even though they contain the same metal ions.

Putting It All Together

Apply the complete ruleset to calculate the oxidation state and derive the final syntax.



1. Identify the Ions

Cation: Potassium (K^+) → Counter-ion goes first.

Complex Anion: $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ → Metal requires -ate ending.

2. Calculate Oxidation State

$$x + 3(-2) = -3 \rightarrow x = +3$$

Chromium is (III).

3. Assemble the Syntax

potassium + tri — oxalato — chromate(III)

potassium trioxalatochromate(III)

Golden Rules of Nomenclature

Run your final chemical names through this checklist to catch common syntax errors.



Cation First

Always name the cation before the anion, regardless of which one is the complex sphere.



Alphabetical Ligands

Ligands are listed alphabetically ignoring their multiplier prefixes.



Unbroken Syntax

There are NO spaces inside the coordination entity's name. It acts as a single continuous word.



Suffix Watch

Anionic complexes end in -ate.
Anionic ligands end in -o / -ido.
Don't confuse the two.



You've Learned the Theory.

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Practice the moment you finish studying
Jump in while the concept is still fresh in your head

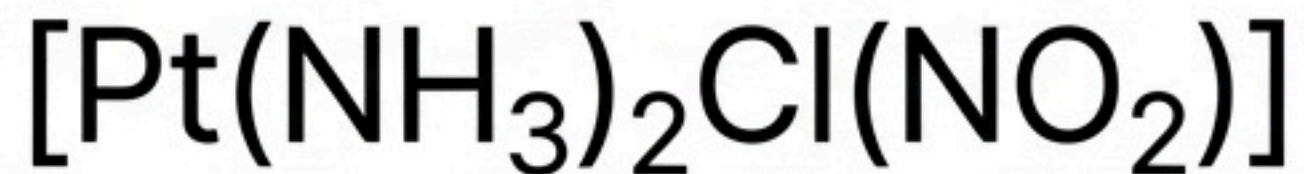
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Test Your Knowledge

Apply the IUPAC rules to these mononuclear coordination compounds from the textbook.

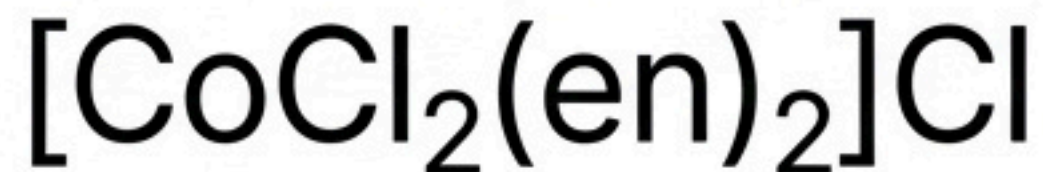


diammine

chlorido

nitrito-N-

platinum(II)



dichlorido

bis(ethane-1,2-diamine)

cobalt(III)

chloride

 **Pro Tip:** Always determine the oxidation state first by balancing the counter ions against the known ligand charges!