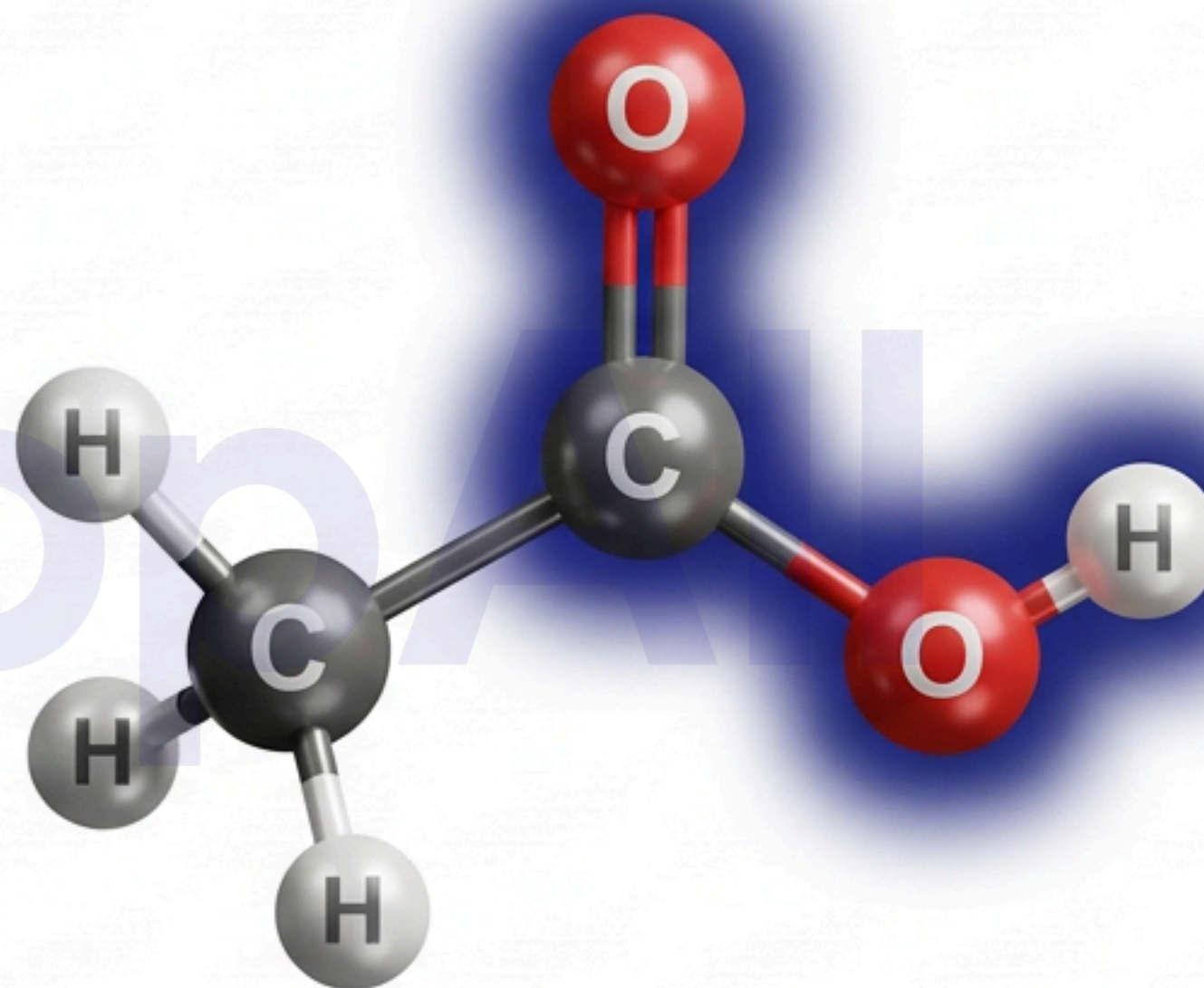


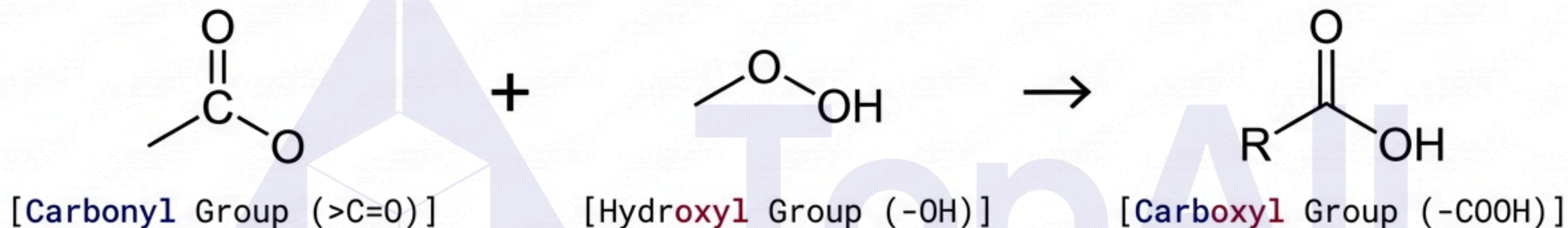
Nomenclature of Carboxylic Acids

From historical common names to systematic IUPAC rules: a comprehensive guide to naming compounds containing the carboxyl group.



Deconstructing the Carboxyl Group

The Equation



Chip A: Aliphatic (RCOOH)

An alkyl group is attached to the carboxyl carbon.

Chip B: Aromatic (ArCOOH)

An aryl (benzene) ring is attached to the carboxyl carbon.

The carboxyl group consists of a carbonyl group attached to a hydroxyl group, hence its name: carb-oxy.

The Etymology of Common Names



Formic acid

(Latin: *formica* = red ant)



Acetic acid

(Latin: *acetum* = vinegar)



Butyric acid

(Latin: *butyrum* = rancid butter)

Common names end with the suffix *-ic acid*. They were established long before molecular structures were known, relying entirely on the physical source of the isolated compound.



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Constructing IUPAC Names

[Alkane] – [e] + [oic acid]

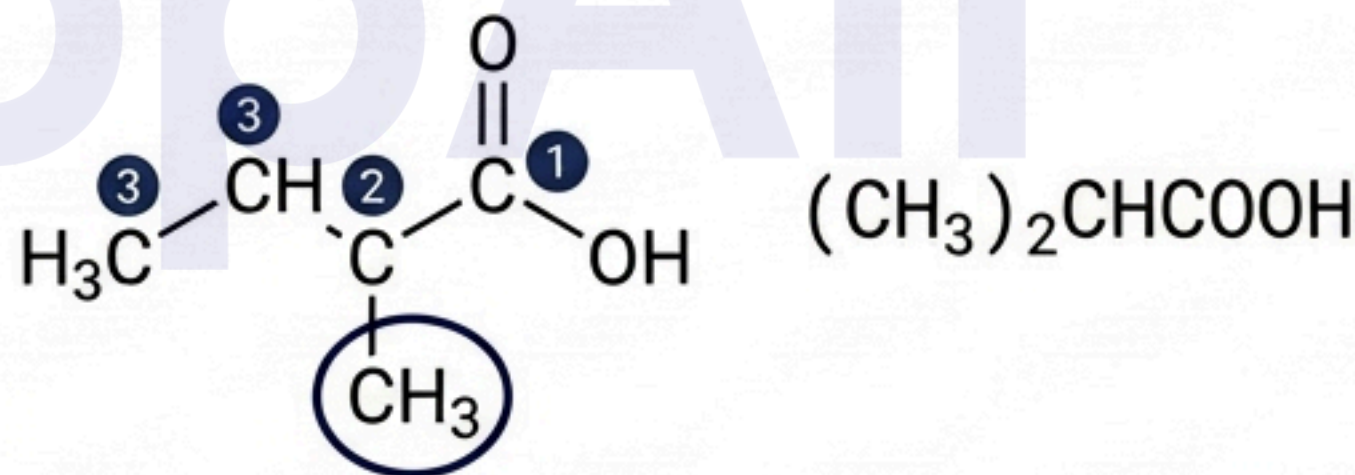
Step 1 (Numbering)

Find the longest carbon chain. The carboxylic carbon is always numbered C-1.

Step 2 (Suffix)

Replace the ending -e of the parent alkane with -oic acid.

Step 3 (Assemble)



[2-Methyl] + [propan] + [oic acid] → **2-Methylpropanoic acid**

Handling Multiple Carboxyl Groups

[Parent Alkane] + [dioic / tri...carboxylic acid]

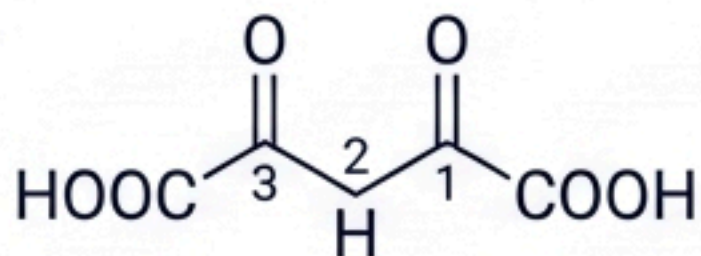
⚠ Exam Alert: Do not drop the 'e' from the alkane name!

The Dicarboxylic Series



n=0		HOOC-COOH		Oxalic acid (Ethanedioic acid)
n=1		HOOC-CH ₂ -COOH		Malonic acid (Propanedioic acid)
n=2		HOOC-(CH ₂) ₂ -COOH		Succinic acid (Butanedioic acid)
n=3		HOOC-(CH ₂) ₃ -COOH		Glutaric acid (Pentanedioic acid)
n=4		HOOC-(CH ₂) ₄ -COOH		Adipic acid (Hexanedioic acid)

Special Case

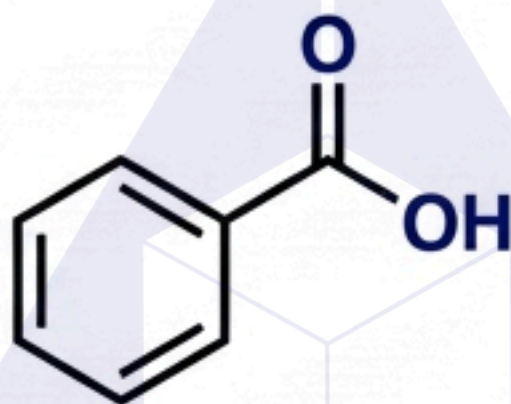


Common: Tricarballic acid.

When >2 carboxyl groups are present, the alkyl chain leaving the carboxyl groups is numbered, and the suffix is -tricarboxylic acid.

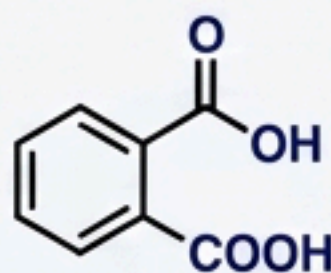
Naming Aromatic Carboxylic Acids

Direct Attachment



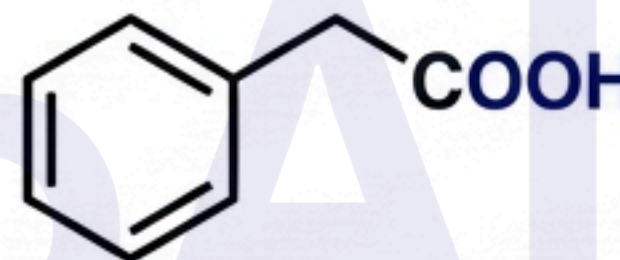
Benzoic acid (Common & Accepted IUPAC)
Benzenecarboxylic acid (Strict IUPAC)

Sub-example:



Phthalic acid (Benzene-1,2-dicarboxylic acid)

Side-Chain Attachment



Phenylacetic acid (Common)
2-Phenylethanoic acid (IUPAC)

Rule Note

When the carboxyl group is on an aliphatic side chain, the aromatic ring is treated as a phenyl substituent.

Common vs. IUPAC Nomenclature Matrix

Structure	Common Name	IUPAC Name
HCOOH	Formic acid	Methanoic acid
CH_3COOH	Acetic acid	Ethanoic acid
$\text{HOOC}-\text{COOH}$	Oxalic acid	Ethanedioic acid
$\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$	Adipic acid	Hexanedioic acid
$\text{Ph}-\text{COOH}$	Benzoic acid	Benzenecarboxylic acid



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