

Name: _____ Period: _____ Date: _____

Naming Decision Tree

Learning goal

I can decide which naming system to use for any compound, and name it correctly.

Part 1 · Notes

Fill in each blank using the word bank for that section.

Section A · One Tree for Every Compound

Word bank

prefixes · ionic

- You now know four sets of naming rules: ionic names with the -ide ending (C7.05), polyatomic ions (C7.06), Roman numerals (C7.07) and prefixes for molecular compounds (C7.08). Using the wrong set gives a wrong name. A **decision tree** asks yes/no questions in a set order, and the answers lead you to the right rules.

Question	If yes	If no
1. Does the formula start with a metal or NH_4^+ ?	Ionic: never use prefixes. Go to 2.	Molecular (only nonmetals): use prefixes. Stop.
2. Can the metal have more than one charge? (Fe, Cu, Sn, Pb, Mn, Cr)	Add a Roman numeral for its charge.	No numeral (Groups 1 and 2, Al, Zn, Ag, NH_4^+).
3. Is the negative part one element?	Root + -ide (chloride, oxide).	Polyatomic: the ion's own name (sulfate, nitrate).

- A compound made only of nonmetals is named with _____. NH_4Cl starts with the polyatomic ion NH_4^+ , so it is _____.

Remember

Ask the questions in order. Question 1 comes first because prefixes are only for molecules, and molecules have no charges to ask about.

Section B · Sort Any Compound

Word bank

zinc chloride · Roman numeral

- Walk each formula through the tree, one question at a time.
- **Worked example: FeSO_4 .** Fe is a metal → ionic. Iron can be 2+ or 3+ → Roman numeral. SO_4^{2-} is polyatomic → sulfate. One SO_4^{2-} (−2) means Fe^{2+} : **iron(II) sulfate**.
- **Worked example: ZnO .** Zn is a metal → ionic. Zinc is only ever 2+ → no numeral. O is one element → oxide: **zinc oxide**.
- **Worked example: N_2O_4 .** N and O are both nonmetals → molecular → prefixes: **dinitrogen tetroxide**.
- ZnCl_2 is named _____. $\text{Cu}(\text{NO}_3)_2$ goes down the _____ branch.

Remember

Zinc and silver are transition metals, but they have only one charge, so they never get a numeral. The question is “more than one charge?”, not “transition metal?”

Section C · Name It Right

Word bank

copper(II) chloride

- The same elements can land on different branches. Look at three chlorides:

Formula	Branch	Name
CaCl_2	ionic · no numeral	calcium chloride
CuCl_2	ionic · Roman numeral	copper(II) chloride
SCl_2	molecular · prefixes	sulfur dichloride

- All three have two chlorines, but only the molecule says “di.” CuCl_2 is named _____.

Remember

Prefixes and Roman numerals never appear in the same name. If your name has both, go back to question 1.

Part 2 · Practice

Card 1 · Build the tree (do this after Section A)

Cards: Metal or NH_4^+ first? · More than one charge? · Negative part: one element or polyatomic? · Molecular: use prefixes · Add a Roman numeral · No numeral · Root + -ide · The polyatomic ion's name

Box	Write the card that goes here
Question 1 (top)	
Question 1 → No	
Question 2	
Question 2 → Yes	
Question 2 → No	
Question 3	
Question 3 → one element	
Question 3 → polyatomic	

Why does the tree ask “Metal or NH_4^+ first?” before it asks about charges?

Sentence stem: “It asks that first because _____. If you asked about charges first, _____.”

Card 2 · Sort (do this after Section B)

Answer the questions in order. Write — when a question isn't asked (molecules stop after question 1). System: prefixes, no numeral, or Roman numeral.

Formula	1. Metal or NH_4^+ ? (Y/N)	2. More than one charge? (Y/N/—)	3. One element or polyatomic? (E/P/—)	System
CO_2				
NaCl				
FeCl_3				
NaOH				
N_2O_4				
ZnO				
CuO				
$\text{Ca}(\text{NO}_3)_2$				
PCl_3				
NH_4Cl				
Cu_2O				
AgNO_3				
SF_6				
FeSO_4				
$\text{Al}(\text{OH})_3$				

NH_4Cl has no metal at all. Why does it still go down the ionic branch?

Sentence stem: “ NH_4Cl is ionic because ____, so its name ____.”

Card 3 · Name it (do this after Section C)

Pick the branch first, then write the name. Never a prefix and a numeral in the same name.

Formula	Which branch? (prefixes / no numeral / Roman numeral)	Name
CaCl_2		
CuCl_2		
SCl_2		
Fe_2O_3		
N_2O_4		
K_2SO_4		
NH_4NO_3		
ZnO		

CuCl_2 is copper(II) chloride, but SCl_2 is sulfur dichloride. Both have two chlorines. Why are the names built differently?

Sentence stem: “ CuCl_2 gets a numeral because _____. SCl_2 gets a prefix because _____.”

Part 3 · Checkpoints

How to use this section

1. Answer the ▲ main questions for each checkpoint.
2. Check your answers with your teacher.
3. Your teacher may give you a ● or ■ page for that checkpoint. Finish it before you move on.

Checkpoint 1 · Which naming system?

▲ Main questions

T1.1. Which compound is molecular?

- A. PCl_3
- B. NH_4Cl
- C. CuO
- D. KCl

T1.2. Which compound's name needs a Roman numeral?

- A. SO_2
- B. CuSO_4
- C. Na_2SO_4
- D. ZnCl_2

T1.3. Which compound's name uses prefixes?

- A. CaCl_2
- B. Fe_2O_3
- C. N_2O_4
- D. Al_2O_3

T1.4. NH_4NO_3 contains only nonmetals. How is it named?

- A. It can't be named
- B. As a molecule, with prefixes
- C. With a Roman numeral
- D. As an ionic compound: the two ions' names, no prefixes

Checkpoint 2 · Name it correctly

▲ Main questions

T2.1. Name Fe_2O_3 .

- A. diiron trioxide
- B. iron(III) oxide
- C. iron oxide
- D. iron(II) oxide

T2.2. Name K_2SO_4 .

- A. potassium sulfide
- B. dipotassium sulfate
- C. potassium sulfate
- D. potassium(I) sulfate

T2.3. Name PCl_5 .

- A. monophosphorus pentachloride
- B. phosphorus chloride
- C. pentaphosphorus chloride
- D. phosphorus pentachloride

T2.4. What is the formula for calcium nitrate?

- A. $\text{Ca}(\text{NO}_3)_2$
- B. CaNO_{32}
- C. CaNO_3
- D. Ca_2NO_3

Part 4 · Claim, Evidence, Reasoning

Question: NH_4Cl is made only of nonmetals. Use the decision tree to explain how it should be named, and give its name.

	NH_4Cl
Elements	N, H, Cl (all nonmetals)
Particles	NH_4^+ ions and Cl^- ions
Looks like	a white crystalline solid
Dissolved in water	it conducts electricity (it has ions)

Sentence stems (use them if you need them)

I claim that NH_4Cl is named ____ because ____.

My evidence is that NH_4Cl is made of ____ and it ____ when dissolved.

Using the tree: question 1 ____, question 2 ____, question 3 ____.

Evidence bank: NH_4^+ ions · Cl^- ions · conducts electricity · positive polyatomic ion · no prefixes · one charge · -ide · ammonium chloride

Claim:

Evidence:

Reasoning:

■ Take it further

Someone says NH_4Cl is all nonmetals, so it should be “nitrogen tetrahydrogen chloride.” Respond, and explain why the tree asks about NH_4^+ in its first question.

Glossary · Glosario · Bảng thuật ngữ

English	Español	Tiếng Việt
decision tree: a chart of yes/no questions, asked in order, that leads you step by step to an answer	árbol de decisiones: un diagrama de preguntas de sí o no, en orden, que te lleva paso a paso a una respuesta	cây quyết định: sơ đồ các câu hỏi có/không theo thứ tự, dẫn em từng bước đến câu trả lời

Key directions · Instrucciones · Hướng dẫn

English	Español	Tiếng Việt
Put each card in the right place in the tree.	Coloca cada tarjeta en el lugar correcto del árbol.	Đặt mỗi thẻ vào đúng vị trí trên cây.
Answer each question to sort the compound.	Responde cada pregunta para clasificar el compuesto.	Trả lời từng câu hỏi để phân loại hợp chất.
Pick the naming system, then build the name.	Elige el sistema de nombres y luego forma el nombre.	Chọn cách gọi tên, rồi ghép tên.

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Checkpoint 1 · Which naming system?

- Your teacher gave you this page. Finish it before you move on to the next section.

• Need a boost?

The tree: 1. Metal or NH_4^+ first? No → prefixes. Yes → no prefixes. 2. More than one charge (Fe, Cu, Sn, Pb, Mn, Cr)? Yes → Roman numeral. No → no numeral. 3. Negative part: one element → -ide; polyatomic → the ion's name.

S1.1. CO_2 is made of two nonmetals. Which naming system does it use?

- A. No numeral
- B. Prefixes
- C. Roman numeral

S1.2. FeCl_3 contains iron, which can be $2+$ or $3+$. Which naming system does it use?

- A. No numeral
- B. Prefixes
- C. Roman numeral

S1.3. NaCl starts with sodium, which is always $1+$. Which naming system does it use?

- A. No numeral
- B. Prefixes
- C. Roman numeral

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Checkpoint 2 · Name it correctly

- Your teacher gave you this page. Finish it before you move on to the next section.

• Need a boost?

The tree: 1. Metal or NH_4^+ first? No → prefixes. Yes → no prefixes. 2. More than one charge (Fe, Cu, Sn, Pb, Mn, Cr)? Yes → Roman numeral. No → no numeral. 3. Negative part: one element → -ide; polyatomic → the ion's name.

S2.1. Name MgO .

- A. magnesium(II) oxide
- B. magnesium oxide
- C. magnesium monoxide

S2.2. Name SO_2 .

- A. monosulfur dioxide
- B. sulfur oxide
- C. sulfur dioxide

S2.3. Name CuCl_2 .

- A. copper(II) chloride
- B. copper dichloride
- C. copper chloride

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Checkpoint 1 · Which naming system?

■ Your teacher gave you this page. Try these after your main questions.

■ Take it further

H1.1. Which order of questions works for every compound?

- A. Any order works
- B. Negative part? → metal first? → more than one charge?
- C. More than one charge? → metal first? → negative part?
- D. Metal or NH_4^+ first? → more than one charge? → negative part?

H1.2. Which pair uses the **same** naming system?

- A. ZnO and NaCl
- B. CuO and ZnO
- C. FeO and MgO
- D. SO_2 and Na_2O

H1.3. AgNO_3 has a transition metal but no Roman numeral, and N_2O_3 has numbers in its name but no charges. Explain how the tree handles each.

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Checkpoint 2 · Name it correctly

■ Your teacher gave you this page. Try these after your main questions.

■ Take it further

H2.1. Which name is written correctly?

- A. dinitrogen trioxide (N_2O_3)
- B. calcium dichloride (CaCl_2)
- C. dialuminum trioxide (Al_2O_3)
- D. copper dioxide (CuO)

H2.2. What is the formula for iron(II) nitrate?

- A. $\text{Fe}(\text{NO}_3)_3$
- B. $\text{Fe}(\text{NO}_3)_2$
- C. FeNO_3
- D. Fe_2NO_3

H2.3. A student names CuCl_2 “copper dichloride” and NCl_3 “nitrogen chloride.” Fix both names and explain each fix.
