

Part D: Naming & Formula of Polyatomic Ionic Compounds

April 10, 2019 3:16 PM

PART D: NAMING & FORMULA OF POLYATOMIC IONIC COMPOUNDS

REMEMBER THAT:

A polyatomic ion is composed of more than one type of atom joined by covalent bonds.





































Because polyatomic ions carry an electric charge, they cannot exist on their own.

An example of a polyatomic ion is:



The figure right (and your data booklet) lists some common polyatomic ions.

You do not have to memorize the names.

POLYATOMIC IONS: NAMES, FORMULAE & CHARGES											
 Ammonium Formula: NH_4^+	 Nitrite Formula: NO_2^-	 Nitrate Formula: NO_3^-	 Carbonate Formula: CO_3^{2-}	 Sulfite Formula: SO_3^{2-}	 Sulfate Formula: SO_4^{2-}	 Phosphate Formula: PO_4^{3-}	 Hydroxide Formula: OH^-	 Cyanide Formula: CN^-	 Acetate Formula: $\text{C}_2\text{H}_3\text{O}_2^-$	 Perchlorate Formula: ClO_4^-	 Chlorate Formula: ClO_3^-
 Selenite Formula: SeO_3^{2-}	 Selenate Formula: SeO_4^{2-}	 Tellurite Formula: TeO_3^{2-}	 Tellurate Formula: TeO_4^{2-}	 Bromate Formula: BrO_3^-	 Iodate Formula: IO_3^-	 Periodate Formula: IO_4^-	 Borate Formula: BO_3^{3-}	 Manganate Formula: MnO_4^{2-}	 Manganite Formula: MnO_3^-	 Chromate Formula: CrO_4^{2-}	 Dichromate Formula: $\text{Cr}_2\text{O}_7^{2-}$
 Percarbonate Formula: $\text{C}_2\text{O}_6^{2-}$	 Permanganate Formula: MnO_4^-	 Fluoride Formula: F^-	 Phosphate Formula: PO_4^{3-}	 Sulfate Formula: SO_4^{2-}	 Sulfite Formula: SO_3^{2-}	 Nitrate Formula: NO_3^-	 Nitrite Formula: NO_2^-	 Carbonate Formula: CO_3^{2-}	 Bicarbonate Formula: HCO_3^-	 Sulfate Formula: SO_4^{2-}	 Sulfite Formula: SO_3^{2-}

PRACTICE

Write the name or formula of the following polyatomic ions:

- NH_4^+ ammonium ion
- CrO_4^{2-} chromate ion
- Acetate CH_3COO^-
- CN^- cyanide ion
- SO_4^{2-} sulphate
- Sulfite SO_3^{2-}
- Hypochlorite ClO^-
- OH^- hydroxide ion
- Bisulphite HSO_3^-
- HCO_3^- hydrogen carbonate (or bicarbonate)

* when we name with polyatomics we NEVER change name in any way.

- Polyatomic ions are treated just like other ion but when naming compounds we DO NOT change their endings (they are already ions)
 - Example: NO_3^- is nitrate, not nitraide. no "ide" ending!
- You will recognize that there is a polyatomic ion present, because the compound will look like it has more than TWO Parts. It doesn't! Just split up the compound after the metal, and then find the other ion in your data booklet. most polyatomics have all non-metals.
- Remember to use BRACKETS in the formula if more than one is present, as you will see from examples.

1. FROM CHEMICAL FORMULA --> COMPOUND NAME



Step 1: How do you know you are dealing with a polyatomic ion?
there are more than 2 elements



Step 2: Ca $^{2+}$ CO_3 $^{2-}$ ion

don't change endings!

Step 1: How do you know you are dealing with a polyatomic ion?
 there are more than 2 elements

Step 2: identify metal: Ca^{2+} = calcium ~~ion~~ (don't change ending for polyatomic ion)

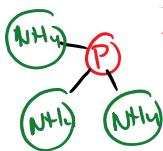
Step 3: identify non-metal part: CO_3^{2-} = carbonate ~~ion~~
 name: Calcium carbonate

Step 1: NH_4Cl 3 elements are involved: N, H, Cl => has polyatomic ions.

Step 2: NH_4^+ is a metal polyatomic ion (+) = Ammonium

Step 3: Cl^- is a non-metal ion = chloride
 Name: ammonium chloride

PRACTICE Write the name of the following compounds that contain polyatomic ions.

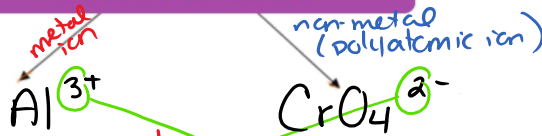


Example: Write the name of the following compounds.

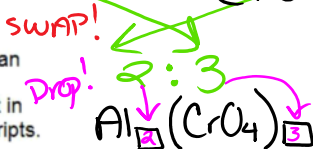
	periodic table	polyatomic ion table	
1. Li_3PO_4	Li^{+1}	PO_4^{-3}	Li_3PO_4 lithium phosphate
2. $(\text{NH}_4)_3\text{P}$	NH_4^{+1}	P^{-3}	$(\text{NH}_4)_3\text{P}$ ammonium phosphide
3. $\text{Ca}(\text{OH})_2$	Ca^{+2}	OH^{-1}	$\text{Ca}(\text{OH})_2$ calcium hydroxide
4. $\text{Fe}(\text{OH})_3$	Fe^{+3}	OH^{-1}	$\text{Fe}(\text{OH})_3$ iron (III) hydroxide.
5. $\text{Mn}(\text{SO}_4)_2$	Mn^{+4}	SO_4^{-2}	$\text{Mn}(\text{SO}_4)_2$ manganese (IV) sulphate.

2. FROM COMPOUND NAME --> CHEMICAL FORMULA

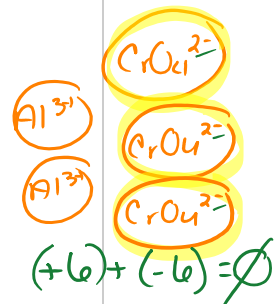
Aluminum chromate



Note that if there is more than one of the polyatomic compounds, you must put it in parenthesis and add subscripts.



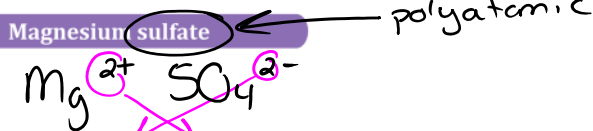
Cross the charges circled to balance and neutralize the compound.

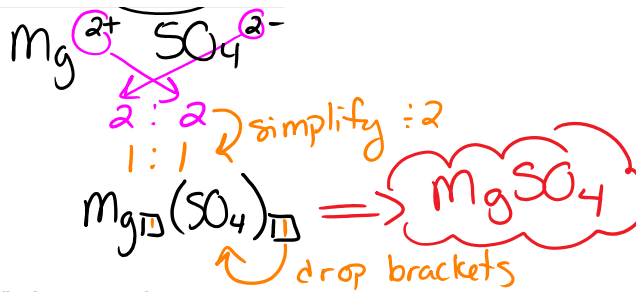


Notice the use of brackets in the formula to allow the ratio of ions to be shown correctly. Brackets are dropped if the ion is not polyatomic or if the ratio number outside the brackets is 1.

When you read the formula, you should always remember that the ratio numbers and brackets are implied.

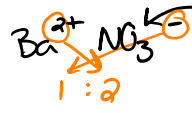
FOR EXAMPLE: Na_2CO_3 as sodium carbonate with 2 Na^+ ions for every 1 CO_3^{2-} ion.
 $\text{Ca}(\text{OH})_2$ as calcium hydroxide with 1 Ca^{2+} ions for every 2 OH^- ion.





PRACTICE

1. Write the formula of each of the following compounds:



a. barium nitrate	$Ba(NO_3)_2$	a. barium nitrate	$Ba(NO_3)_2$
b. potassium carbonate	K_2CO_3	b. potassium carbonate	K_2CO_3
c. nickel (II) sulfate	$NiSO_4$	c. nickel (II) sulfate	$NiSO_4$
d. magnesium phosphate	$Mg_3(PO_4)_2$	d. magnesium phosphate	$Mg_3(PO_4)_2$
e. sodium dichromate	$Na_2Cr_2O_7$	e. sodium dichromate	$Na_2Cr_2O_7$
f. iron (II) chromate	$FeCrO_4$	f. iron (II) chromate	$FeCrO_4$
g. lead (IV) acetate	$Pb(CH_3COO)_4$	g. lead (IV) acetate	$Pb(CH_3COO)_4$
h. ammonium sulfate	$(NH_4)_2SO_4$	h. ammonium sulfate	$(NH_4)_2SO_4$

Homework

ASSIGNMENT #6: Ionic Compounds with POLYATOMIC IONS Naming & Formula Review + MAZE on page 27
 This assignment is to be completed below in the space provided.

Part 1 – Write the name for each of the following ionic compounds.

- | | |
|------------------------------------|--|
| 1. Na_2CO_3 sodium carbonate | 2. $Fe(OH)_3$ _____ |
| 3. KCH_3COO _____ | 4. $Co(ClO)_2$ _____ |
| 5. $(NH_4)_3PO_4$ _____ | 6. $Mg_3(PO_4)_2$ _____ |
| 7. $Ca(CH_3COO)_2$ _____ | 8. $Mg_3(PO_3)_2$ _____ |
| 9. $(NH_4)_3P$ ammonium phosphide | 10. $Ni(HS)_3$ nickel (III) bisulphide |
| 11. $(NH_4)_3PO_4$ _____ | 12. $CuCN$ copper(I) cyanide |
| 13. $Al(OH)_3$ aluminium hydroxide | 14. $Mn(SO_3)_2$ manganese(II) sulphite. |

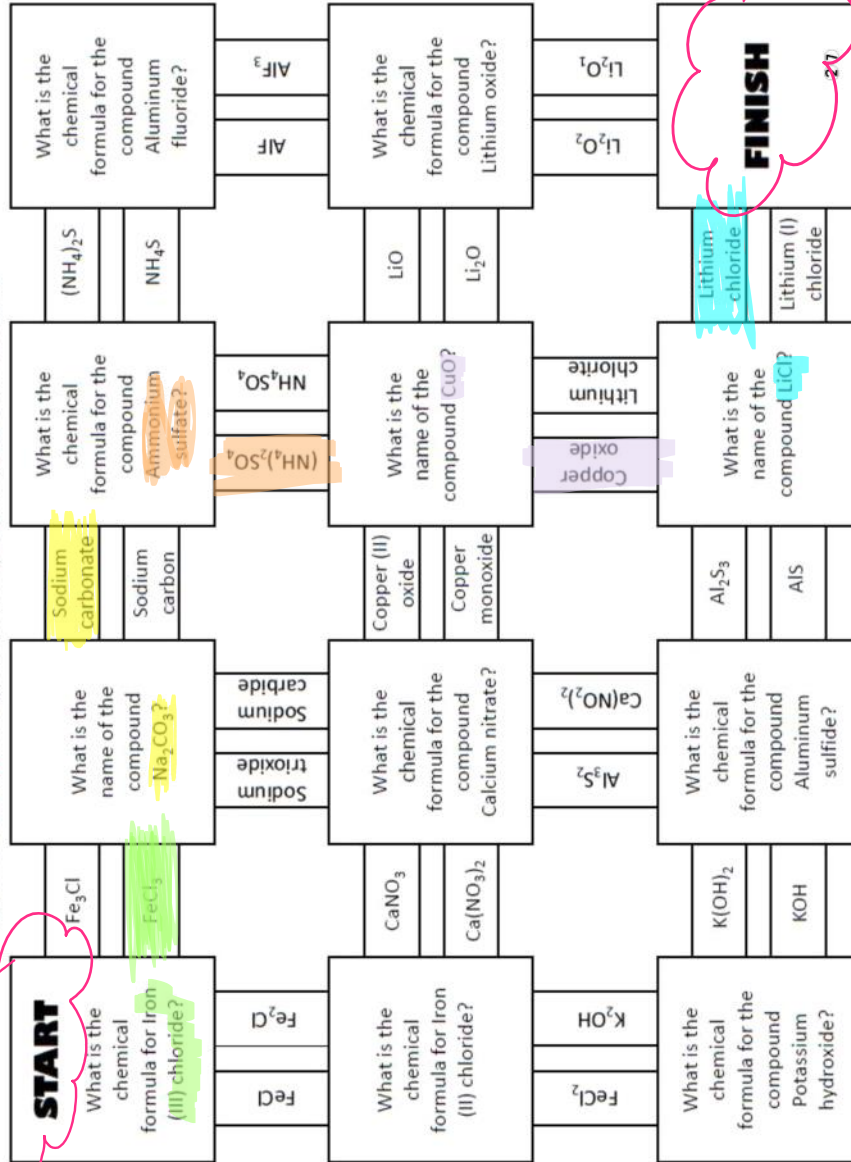
HW April 16

Part 2 – Write the formula for each of the following ionic compounds:

Compound Name	Work	Formula
15. calcium carbonate		$CaCO_3$
16. manganese (III) chlorate	$Mn^{3+} ClO_3^-$	$Mn(ClO_3)_3$
17. lithium fluoride	$Li^+ F^-$	LiF
18. potassium permanganate	$K^+ MnO_4^-$	$KMnO_4$
19. sodium chromate	$Na^+ CrO_4^{2-}$	Na_2CrO_4
20. ammonium nitrate	$NH_4^+ NO_3^-$	NH_4NO_3
21. lithium hydroxide	$Li^+ OH^-$	$LiOH$
22. aluminum hydroxide	$Al^{3+} OH^-$	$Al(OH)_3$
23. lead (II) perchlorate	$Pb^{2+} ClO_4^-$	$Pb(ClO_4)_2$
24. iron (III) hydrogen sulfide	$Fe^{3+} HS^-$	$Fe(HS)_3$
25. vanadium (V) nitrate	$V^{5+} NO_3^-$	$V(NO_3)_5$
26. chromium (II) nitrite	$Cr^{2+} NO_2^-$	$Cr(NO_2)_2$
27. nickel (III) sulfite	$Ni^{3+} SO_3^{2-}$	$NiSO_3$

Ionic Compounds Maze

Directions: Read the question in the START block. Choose the path to the next question by choosing the correct answer. Color the questions and answers of your path as you move from START to FINISH.



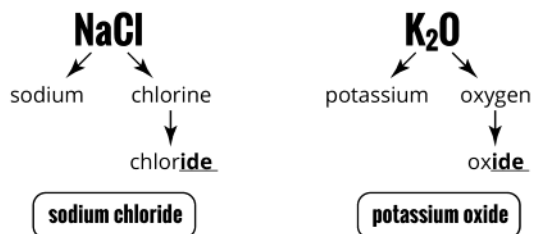
Writing Compound Names

Ionic Bonds

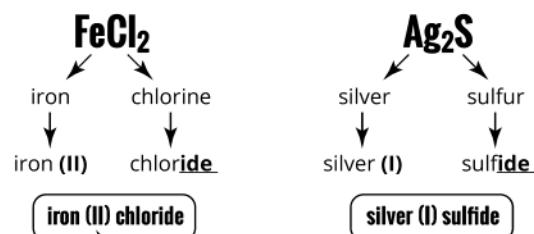
(a bond between a metal and a nonmetal)

Naming a Binary Ionic Compound

(two elements with no transition metals)

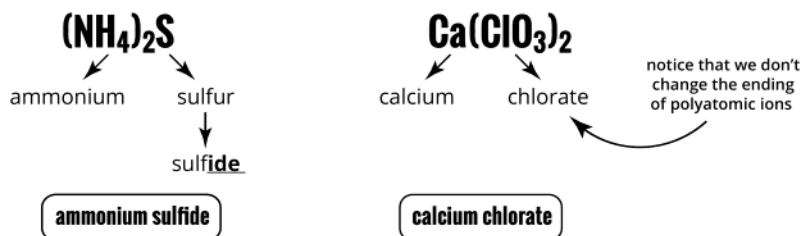


Naming a Compound with a Transition Metal



you can figure out this number based on the number of atoms of the second element

Naming a Compound with a Polyatomic Ion

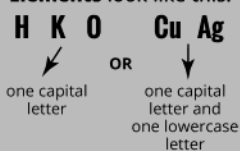


Element or Polyatomic Ion?

Elements are found on the periodic table.



Elements look like this:

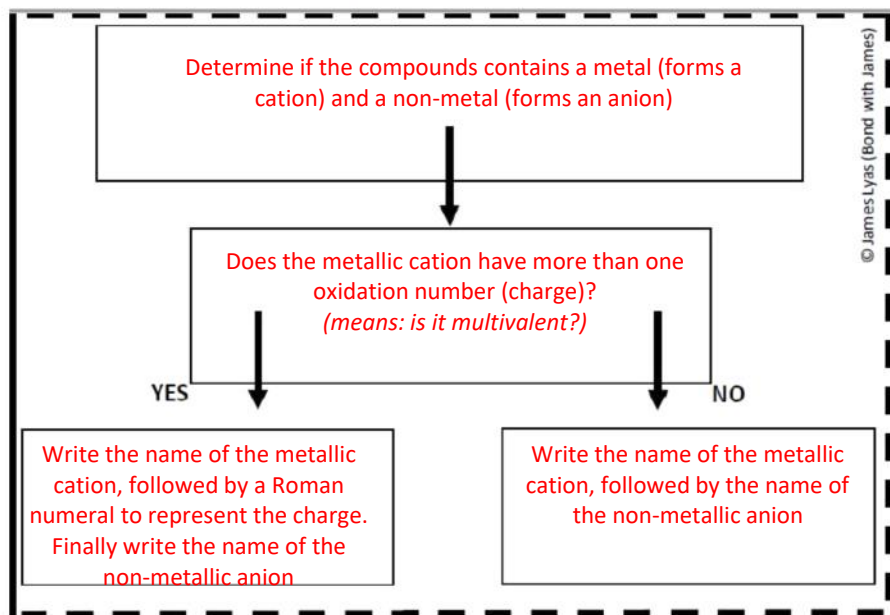


Polyatomic ions are groups of two or more elements.



They stick together.

Steps for Naming Binary Ionic Compounds



Directions: Cut out the organizer and smaller pieces along the dotted lines only. Then tape or glue the pieces to help construct a logical sequence of steps for naming ionic compounds.

Recreating, scanning, electronic copying, file sharing, redistributing, editing, selling, or posting this item (or any part thereof) on the Internet, or with others, is strictly prohibited. Violations are subject to the penalties of the Digital Millennium Copyright Act. © James Lyas (Bond with James)

Determine if the compound contains a metal (forms a cation) and a non-metal (forms an anion).

Write the name of the metallic cation, followed by a Roman numeral to represent the charge. Finally write the name of the non-metallic anion.

Write the name of the metallic cation, followed by the name of the non-metallic anion.

Does the metallic cation have more than one oxidation number?

