TERNARY IONIC BONDING WITH MANIPULATIVES VIRTUAL LAB

Type your name here

What are polyatomic ions?

Sometimes covalently bonded compounds (compounds containing only non-metals) have an overall charge. Sulfate, for example, is a covalent compound of sulfur and oxygen. Sulfur can have more than 8 valence electrons due to its 3d orbital. But this stable configuration also requires 2 more electrons than would be expected. Therefore, sulfate has a 2- charge. Sulfate (and other negative polyatomic ions) can bind to positive ions in the same way that simple atom ions are bound together. There are also a couple positive polyatomic ions, like ammonium. See the figures to the right.



Some common polyatomic ions and their charges. I will not make you memorize these but you will need to use a reference sheet.

Common Polyatomic Ions

Name	Formula	Name	Formula
acetate carbonate bicarbonate hydroxide nitrate nitrite chromate dichromate phosphate hydrogen phosphate ammonium hypochlorite chlorate perchlorate permanganate	$C_{2}H_{3}O_{2}^{-1}$ CO_{3}^{2-} HCO_{3}^{-1} OH^{-1} NO_{2}^{-1} CrO_{4}^{2-1} CrO_{4}^{2-1} CrO_{4}^{3-1} HPO_{4}^{3-1} HPO_{4}^{2-1} NH_{4}^{+1} CIO^{-1} CIO_{2}^{-1} CIO_{2}^{-1} CIO_{3}^{-1} CIO_{4}^{-1} MnO_{4}^{-1}	sulfate sulfite hydrogen sulfate hydrogen sulfate peroxide cyanide All of the polyatom composed from not except permangana chromate and dicht They all have an ov charge. They are al except for ammonia	SO_4^2 - SO_3^2 - HSO_4^- HSO_3^- O_2^2 - CN^- ic ions are nmetals ite, romate. erall l anions a which is
		a cation.	

What are ternary ionic compounds?

Binary Ionic Compounds

- Contain only two elements
- One Metal cation and one non-metal anion symbol in formula (with subscripts indicating the number of each element)
- Always end in "ide"

- Cations and anions are attracted to each other in ratios that form neutral compounds
- Share properties that are common to ionic compounds

Ternary Ionic Compounds

- Contain only three or more elements
- Can contain a Metal cation and polyatomic anion OR a polyatomic cation and non-metal anion OR both a polyatomic cation and anion.
- Parentheses are used to indicate the number of each polyatomic ion in the compound.
- Can end in "ite", "ate" or "ide" depending on the anion in the compound

How can we use puzzle pieces to help us visualize polyatomic ions and ternary ionic bonding?

Example: calcium nitrate



Build the following and write the formulas below the compound name. The subscripts of both the cation and anion will represent the pieces (ions) involved. When there is more than 1 polyatomic <u>ion</u> we put it in parentheses!

When naming a ternary ionic compound, we DO NOT change the name of the polyatomic ion. We only change the name of the anion when it is an elemental non-metal anion (in which case it will end with "ide")!

Lithium + Hydroxide Use the pieces necessary to form a rectangle below. Copy and paste as needed



Write the formula!

Beryllium + chromate Use the pieces necessary to form a rectangle below. Copy and paste as needed

Write the formula!



Iron (II) + Sulfate
Use the pieces
necessary to form a
rectangle below. Copy
and paste as needed

Write the formula!



Ammonium + Nitrogen Use the pieces necessary to form a rectangle below. Copy and paste as needed

Write the formula!



LET'S BOND! CHALLENGE PROBLEMS!

Magnesium + Phosphate

Use the pieces necessary to form a rectangle below. Copy and paste as needed.



Write the formula!

Name the compound!

LET'S BOND! ACTIVITY REVIEW AND SUMMARY!

What happens to the total charge of the compound after the ions bond together in ternary compounds? (Hint: this is the same in all ionic compounds).

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How many lithium ions are required to bond with one phosphate ion? Why?

Type Here

How many chlorine ions are required to bond with one ammonium on? Why?

Type Here

How do we indicate that there is more than one polyatomic ion in a compound?

Type Here

SO ARE THERE SOME TRICKS TO MAKE THIS EASIER?

Formula to name use the SAME STRATEGIES.

Name to formula use the SAME STRATEGIES.



The same criss-cross shortcut can be used to write the formulas with polyatomic ions.

