



### Cycle 4 Chemistry I Lesson 3

Write formulas and names for compounds containing polyatomic ions

#### AGENDA

Homework to check? Get it out!

#### WARMUP

What is the formula of magnesium phosphide?

What is the formula of zinc fluoride?

**HW:** Formula Writing WS #5 and #7



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### Polyatomic Ions

- Instead of having ions made of a single atom, many ionic compounds have groups of atoms that are ions.

#### Many Atoms Can Form One Ion

- A simple ion is *monatomic*, which means “one-atom.”
- A **polyatomic ion** is a charged group of two or more bonded atoms that can be considered a single ion.
- Unlike simple ions, most polyatomic ions are made of atoms of several elements. Like simple ions, polyatomic ions either positive or negative charge.





### Naming Ionic Compounds

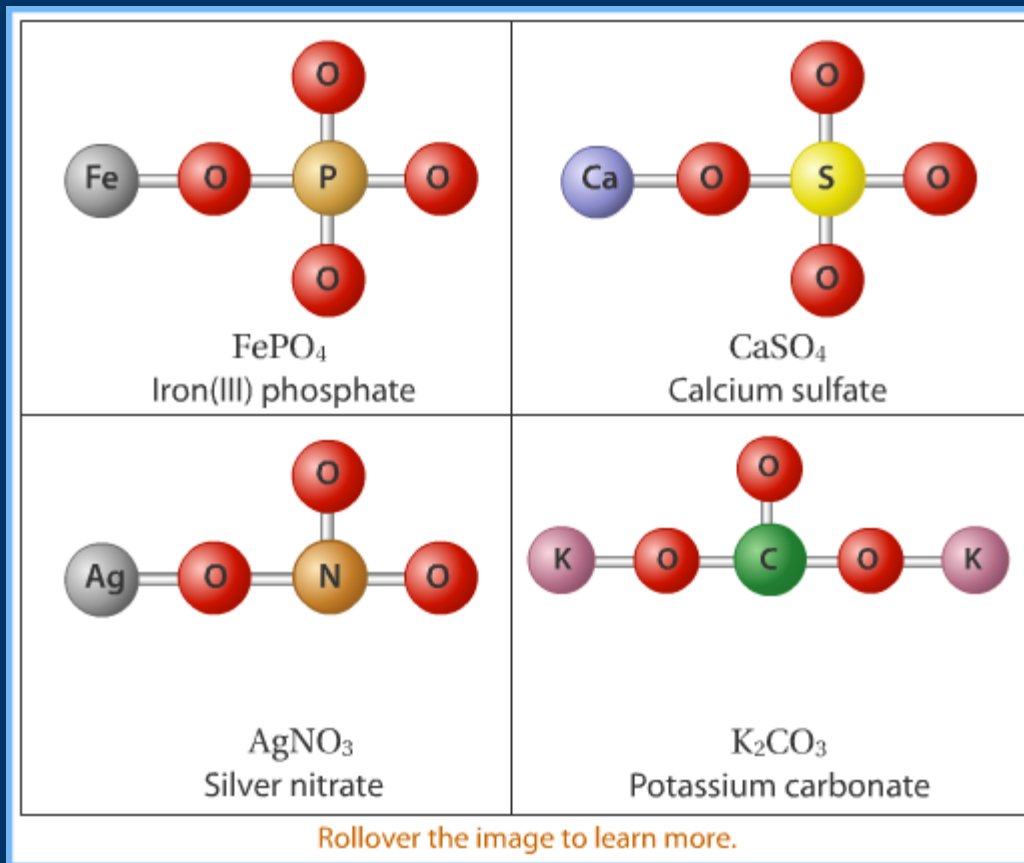
$\text{Ag} - \text{F}$ $\text{AgF}$ Silver fluoride	$\text{Cl} - \text{Ca} - \text{Cl}$ $\text{CaCl}_2$ Calcium chloride
$\text{K} - \text{O} - \text{K}$ $\text{K}_2\text{O}$ Potassium oxide	$\text{Na} - \text{Br}$ $\text{NaBr}$ Sodium bromide

Rollover the image to learn more.





# Naming Compounds Containing Polyatomic Ions



End  
Of  
Slide



### Polyatomic Ions, *continued*

#### Many Atoms Can Form One Ion, *continued*

- Consider the polyatomic ion ammonium,  $\text{NH}_4^+$ .
- Ammonium is made of one nitrogen and four hydrogen atoms.
- They have a total of 11 protons but only 10 electrons.
- So the ammonium ion has a 1+ charge overall.
- This charge is not found on any one atom. Instead, it is spread across this group of bonded atoms.

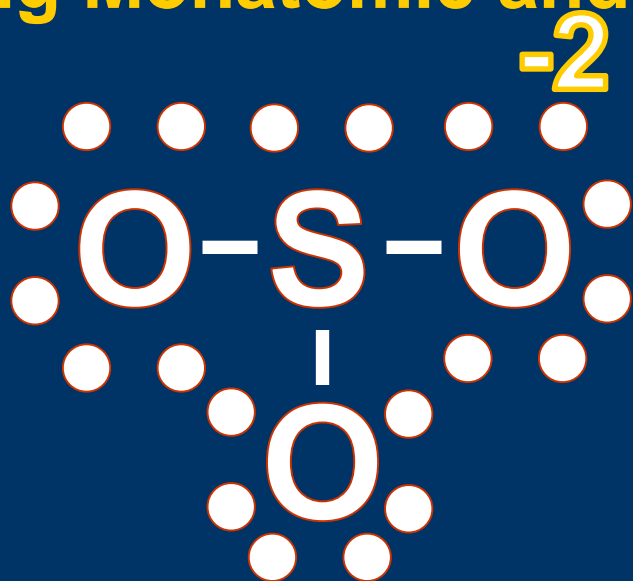




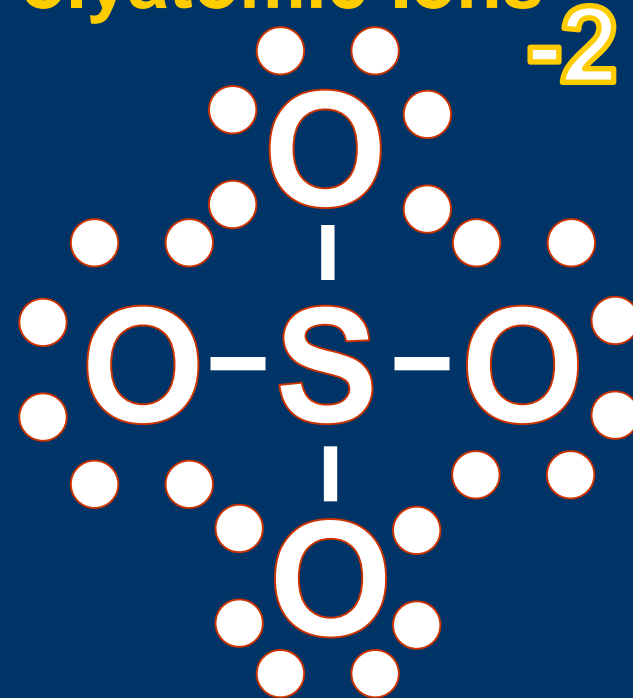
## Comparing Monatomic and Polyatomic Ions



Sulfide  
(Monatomic)



Sulfite  
(Polyatomic)



Sulfate  
(Polyatomic)





### Polyatomic Ions, *continued* Naming Compounds with Polyatomic Ions

- Follow these steps when naming an ionic compound that contains one or more polyatomic ions:
  - Name the cation. Recall that a cation is simply the name of the element.
  - Name the anion. Recall that salts are electrically neutral.
  - Name the salt. Recall that the name of a salt is just the names of the cation and anion.



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### Formula of a Compound with a Polyatomic Ion

#### Sample Problem A

What is the formula for aluminum chromate?



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### Formula of a Compound with a Polyatomic Ion, *continued*

#### Sample Problem A Solution

Determine the formula and charge for the aluminum cation.



Determine the formula and charge for the chromate polyatomic ion.



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### Formula of a Compound with a Polyatomic Ion, *continued*

#### Sample Problem A Solution, *continued*

Because ionic compounds are electrically neutral, the total charges of the cations and anions must be equal.

To balance the charges, find the least common multiple of the ions' charges: for 2 and 3, it is 6.

For 6 positive charges, you need 2  $\text{Al}^{3+}$  ions.

$$2 \times 3 = 6+$$



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## Formula of a Compound with a Polyatomic Ion, *continued*

### Sample Problem A Solution, *continued*

For 6 negative charges, you need  $3\text{CrO}_4^{2-}$  ions.

$$3 \times 2 = 6-$$

The formula must show 2  $\text{Al}^{3+}$  ions and 3  $\text{CrO}_4^{2-}$  ions.

Parentheses are used whenever a polyatomic ion is present more than once.

The formula for aluminum chromate is  $\text{Al}_2(\text{CrO}_4)_3$ .

