

ChemQuest 20

Ionic Bonding Advanced

Name: _____

Date: _____

Hour: _____

Information: Polyatomic Ions

The word, “polyatomic” means “many atoms”. A polyatomic ion, therefore, is an ion that is made of more than one atom. An example of a polyatomic ion is the sulfate ion, SO_4^{2-} . Sulfate is composed of one sulfur atom and four oxygen atoms and overall sulfate has a negative two charge.

Some polyatomic ions:

Sulfate: SO_4^{2-}	Phosphate: PO_4^{3-}	Nitrate: NO_3^-
Cyanide: CN^-	Ammonium: NH_4^+	Chlorate: ClO_3^-
Acetate: $\text{C}_2\text{H}_3\text{O}_2^-$	Hydroxide: OH^-	Carbonate: CO_3^{2-}

Critical Thinking Questions

1. What do all of the polyatomic ions that have the suffix “-ate” have in common?
They all contain oxygen atoms.
2. Which two atoms do you think compose the polyatomic ion called “silicate”?
silicon and oxygen
3. What is the difference between calcium nitride and calcium nitrate?
The -ate ending indicates that calcium nitrate has oxygen in it, but calcium nitride does not.

Information: Writing Formulas With Polyatomic Ions

First of all, you must remember that you can never change the formula for a polyatomic ion. Sulfate is always SO_4^{2-} and never $\text{S}_2\text{O}_8^{4-}$ or something else. Following are some examples of chemical formulas that contain polyatomic ions.

Ammonium chloride is formed from one ammonium ion (NH_4^+) and one chloride ion (Cl^-) to give the formula: NH_4Cl . Sodium sulfate requires two sodium ions (Na^+) because sulfate (SO_4^{2-}) has a negative two charge; the formula is: Na_2SO_4 .

Consider calcium hydroxide. Calcium has a positive two charge (Ca^{2+}) and hydroxide has a negative one charge (OH^-). We need two hydroxide ions to combine with one calcium ion so that the overall charge ends up being zero. We write calcium hydroxide like $\text{Ca}(\text{OH})_2$.

Following are some more examples:

potassium acetate: $\text{KC}_2\text{H}_3\text{O}_2$	magnesium nitrate: $\text{Mg}(\text{NO}_3)_2$
barium phosphate: $\text{Ba}_3(\text{PO}_4)_2$	calcium carbonate: CaCO_3

