

Ionic Bonding

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

Critical Thinking Questions

1. What do all of the polyatomic ions that have the suffix "-ate" have in common?
2. Which two atoms do you think compose the polyatomic ion called "silicate"?
3. What is the difference between calcium nitride and calcium nitrate?

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 $\text{S}_2\text{O}_6^{4-}$ 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: $\text{KC}_2\text{H}_3\text{O}_2$ barium phosphate: $\text{Ba}_3(\text{PO}_4)_2$ magnesium nitrate: $\text{Mg}(\text{NO}_3)_2$ calcium carbonate: CaCO_3

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