

Conceptual Chemistry

Chapter 3: Elements of Chemistry

Polyatomic Ions

Sometimes a molecule can lose or gain a proton (hydrogen ion) to form what we call a polyatomic ion:

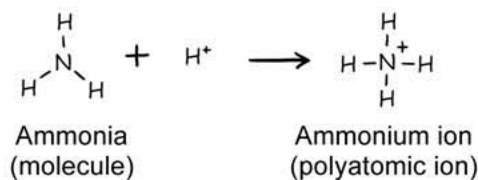
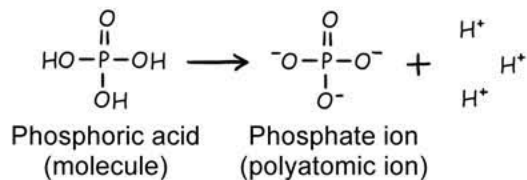
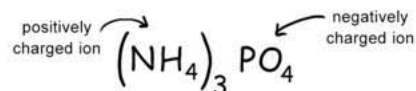


Table of common polyatomic ions

| NAME | FORMULA | NAME | FORMULA |
|-----------------|--------------------|---------------|--------------------|
| Ammonium ion | NH_4^+ | Hydroxide ion | OH^- |
| Bicarbonate ion | HCO_3^- | Nitrate ion | NO_3^- |
| Carbonate ion | CO_3^{2-} | Phosphate ion | PO_4^{3-} |
| Cyanide ion | CN^- | Sulfate ion | SO_4^{2-} |

When it comes to naming compounds, a polyatomic ion is treated as a single unit. Positively charged ions are listed first followed by the negatively charged ions, but we don't include the word "ion". For example, below is the formula for ammonium phosphate. Notice how we need three (1+) ammoniums to balance a single (3-) phosphate.



Use the table of common polyatomic ions to deduce the formula for the following compounds:

Ammonium sulfate $(\text{NH}_4)_2 \text{SO}_4$

Potassium cyanide KCN

Sodium sulfate $\text{Na}_2 \text{SO}_4$

Calcium phosphate $\text{Ca}_3(\text{PO}_4)_2$

Sodium hydroxide NaOH

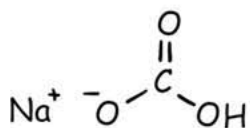
Aluminum hydroxide $\text{Al}(\text{OH})_3$

Hydrogen hydroxide HOH

Aluminum sulfate $\text{Al}_2(\text{SO}_4)_3$

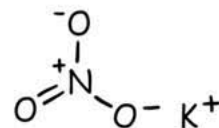
↑ water!

Name the following structures and write their formula based upon the polyatomic ions they contain:



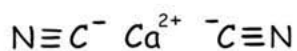
Name: Sodium bicarbonate

Formula: NaHCO_3



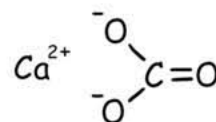
Name: Potassium nitrate

Formula: KNO_3



Name: Calcium cyanide

Formula: $\text{Ca}(\text{CN})_2$



Name: Calcium carbonate

Formula: CaCO_3