

Chemical Formulas and Names

Can you imagine a world where everything has a charge? You couldn't get into a chair if both the chair and you had the same charge; or out of a chair if the chair and you had opposite charges. Neutral objects in close contact do not readily react and can therefore be separated. This is why we can inhale air, extract oxygen from the lungs into the blood stream at the same time that carbon dioxide is exchanged from the blood stream into the lungs, and then exhale a mixture of used and unused gases. Although atoms are neutral, they become charged in chemical reactions that start when atoms are heated, struck, hit, or in close contact with other atoms. The oxidation number is a + or - charge that atoms accept in a chemical reaction in the formation of neutral molecules. The opposite charges within molecules create the force or the chemical "glue" that bonds or holds atoms to one another.

Ions and Their Charges					
Name	Charge	Symbol/Formula	Name	Charge	Symbol/Formula
Lithium	1+	Li ⁺	Chloride	1-	Cl ⁻
Potassium	1+	K ⁺	Iodide	1-	I ⁻
Sodium	1+	Na ⁺	Fluoride	1-	F ⁻
Magnesium	2+	Mg ²⁺	Oxide	2-	O ²⁻
Calcium	2+	Ca ²⁺	Sulfide	2-	S ²⁻
Zinc	2+	Zn ²⁺	Nitride	3-	N ³⁻
Aluminum	3+	Al ³⁺	Phosphide	3-	P ³⁻
Manganese	3+	Mn ³⁺	Carbide	4-	C ⁴⁻

Examine the charges of each pair of ions in the table below. Write the formula of the neutral compound. Use subscripts to show the number of atoms needed to make the compound neutral. Subscripts of 1 are understood and are not placed in the formula. Name the compound using the names from the chart above. Positive ions are written and named first.

Ion and Charge	Na ⁺	Ca ²⁺	Al ³⁺
Cl ⁻			
Name of Compound			
O ²⁻			
Name of Compound			
N ³⁻			
Name of Compound			

Groups of atoms that join and act as a unit with a single charge are called polyatomic ions. If more than one of these ions appears in a compound, parentheses are placed around the ion to help in identifying it in a formula. For example, the nitrate ion (NO_3^-) in the table below has a charge of 1-. Sodium nitrate has the formula of NaNO_3 ; Na is 1+ and NO_3 is 1-. Calcium nitrate has the formula $\text{Ca}(\text{NO}_3)_2$ with parentheses around the nitrate ion since two nitrate ions balance one calcium ion with a charge of 2+.

Polyatomic Ions and Their Charges					
Name	Charge	Symbol/Formula	Name	Charge	Symbol/Formula
Ammonium	1+	NH_4^+	Sulfite	2-	SO_3^{2-}
Nitrate	1-	NO_3^-	Sulfate	2-	SO_4^{2-}
Nitrite	1-	NO_2^-	Carbonate	2-	CO_3^{2-}
Bicarbonate	1-	HCO_3^-	Silicate	2-	SiO_3^{2-}
Hydroxide	1-	OH^-	Thiosulfate	2-	$\text{S}_2\text{O}_3^{2-}$
Acetate	1-	CH_3COO^-	Chromate	2-	CrO_4^{2-}
Bisulfate	1-	HSO_4^-	Dichromate	2-	$\text{Cr}_2\text{O}_7^{2-}$
Chlorate	1-	ClO_3^-	Phosphate	3-	PO_4^{3-}

Examine charges of each pair of ions in the table below. Write the formula and the name of the compound. Use the names from the above chart. Positive ions are written and named first.

Ion and Charge	Na^+	Ca^{2+}	Al^{3+}
HCO_3^-			
Name of Compound			
SO_4^{2-}			
Name of Compound			
PO_4^{3-}			
Name of Compound			

Write the formula for ammonium sulfate, a fertilizer:
