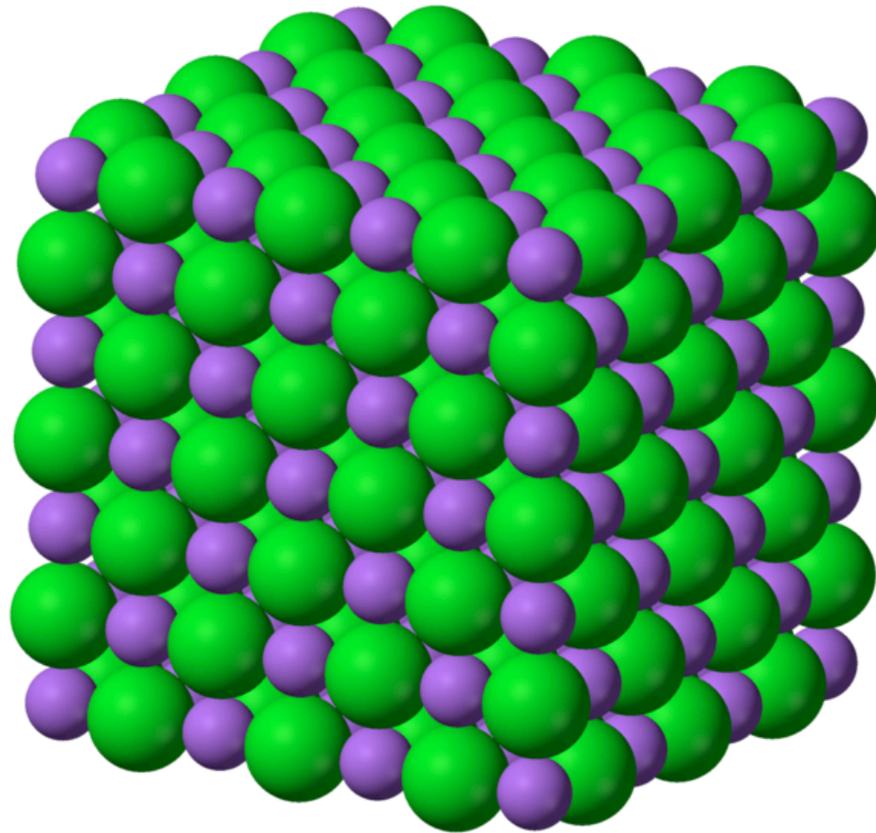


Ionic Compounds



Why does an atom of sodium (Na) and an atom of chlorine (Cl) come together to form NaCl?

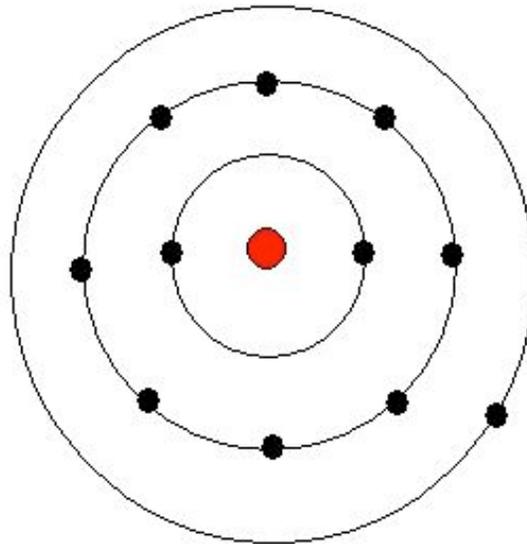


Formation of Table Salt

- Sodium ($1s^2 2s^2 2p^6 3s^1$)

Has: 11 total electrons

1 valence electron

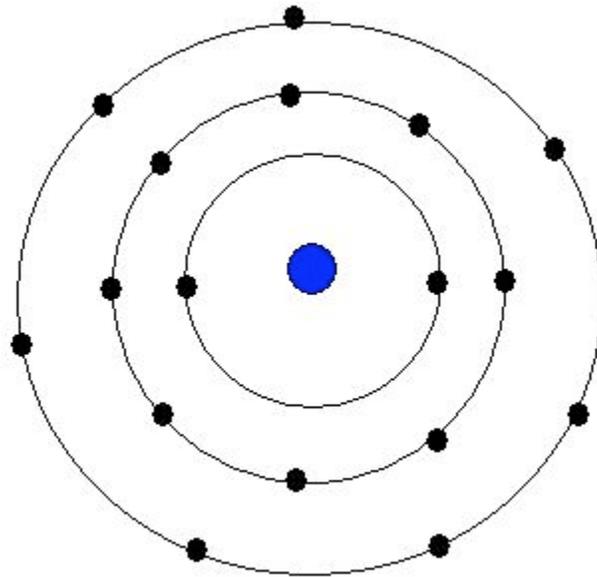


Formation of Table Salt

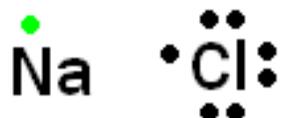
- Chlorine ($1s^2 2s^2 2p^6 3s^2 3p^5$)

Has: 17 total electrons

7 valence electrons



Formation of Table Salt



Sodium: Alkali Metal, Low Electronegativity

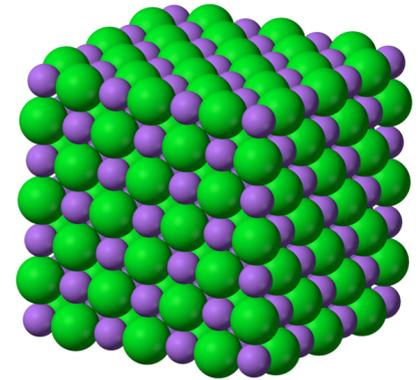


Chlorine: Halogen, High Electronegativity



Ionic Compounds

- The exchange of electrons forms a more stable system.
- When a bond forms, energy is released.
- The formation of an ionic bond is exothermic.
- The structure of an ionic compound is a crystal lattice
- The positive & negative ions arrange themselves in a regular repeating pattern to balance charge.
- Ionic crystals are strong/rigid structures



Ions: Types and Charges

Cation (Metal)

Lose electron(s), has a positive charge

Ex: Na⁺

Anion (Non-Metal)

Gain electron(s), has a negative charge

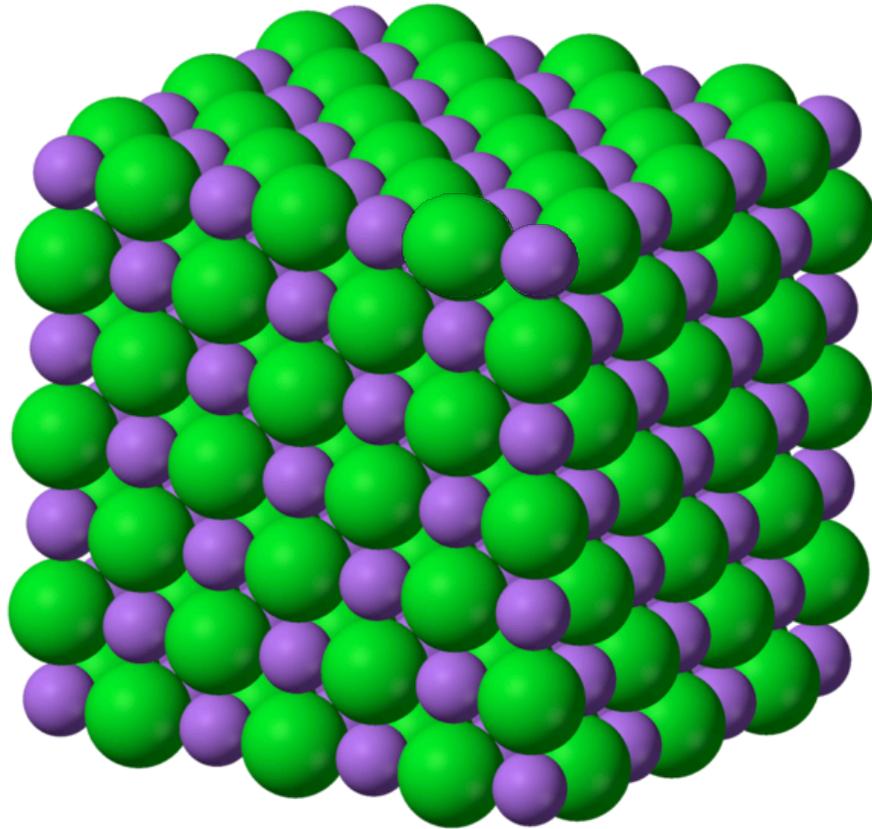
Ex: Cl⁻

Empirical Formula: Shows the simplest whole number ratio of positive ions (cations) to negative ions (anions)

Ex: NaCl = 1:1

Empirical Formulas are also referred to as **Formula Units**, *not* molecules!

Crystal Lattice of Sodium Chloride



Formula unit (NaCl)

Naming of Compounds

Why does a chemist call a bonded sodium atom to a chlorine atom, *sodium chloride*?

Why not just sodium chlorine, or maybe “sodrine,” or perhaps “chlorium,” or even “Bob”?

Naming Binary Ionic Compounds

Ions	Empirical Formula	Compound Name
Na ¹⁺ Cl ¹⁻	NaCl	sodium chloride
Ca ²⁺ Br ¹⁻	CaBr ₂	calcium bromide
Al ³⁺ O ²⁻	Al ₂ O ₃	aluminum oxide
Cs ¹⁺ S ²⁻	Cs ₂ S	cesium sulfide

Binary Ionic Compounds:

- Name the positive (cation) ion using the element's full name.
- Name the negative (anion) ion by dropping the ending and adding the suffix *-ide*.

Naming Transition Metals

Ions		Empirical Formula	Stock System Compound Name	Traditional Compound Name
Cu ¹⁺	O ²⁻	Cu ₂ O	copper (I) oxide	cuprous oxide
Cu ²⁺	O ²⁻	CuO	copper (II) oxide	cupric oxide
Fe ²⁺	O ²⁻	FeO	iron (II) oxide	ferrous oxide
Fe ³⁺	O ²⁻	Fe ₂ O ₃	iron (III) oxide	ferric oxide

Transition Metal Ions:

- Use roman numerals to represent the charge of the metal (SS)
- Use the suffix *-ic* to identify the higher charge (Traditional)
- Use the suffix *-ous* to identify the lower charge (Traditional)

Naming Ternary Compounds

Ions	Empirical Formula	Compound Name
Na^{1+} $\text{C}_2\text{H}_3\text{O}_2^{1-}$	$\text{NaC}_2\text{H}_3\text{O}_2$	sodium acetate
Mg^{2+} $\text{C}_2\text{H}_3\text{O}_2^{1-}$	$\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$	magnesium acetate
Al^{3+} CN^{1-}	$\text{Al}(\text{CN})_3$	aluminum cyanide
NH_4^{1+} NO_2^{1-}	NH_4NO_2	ammonium nitrite

Ternary Compounds:

(Ionic Compounds with more than two elements)

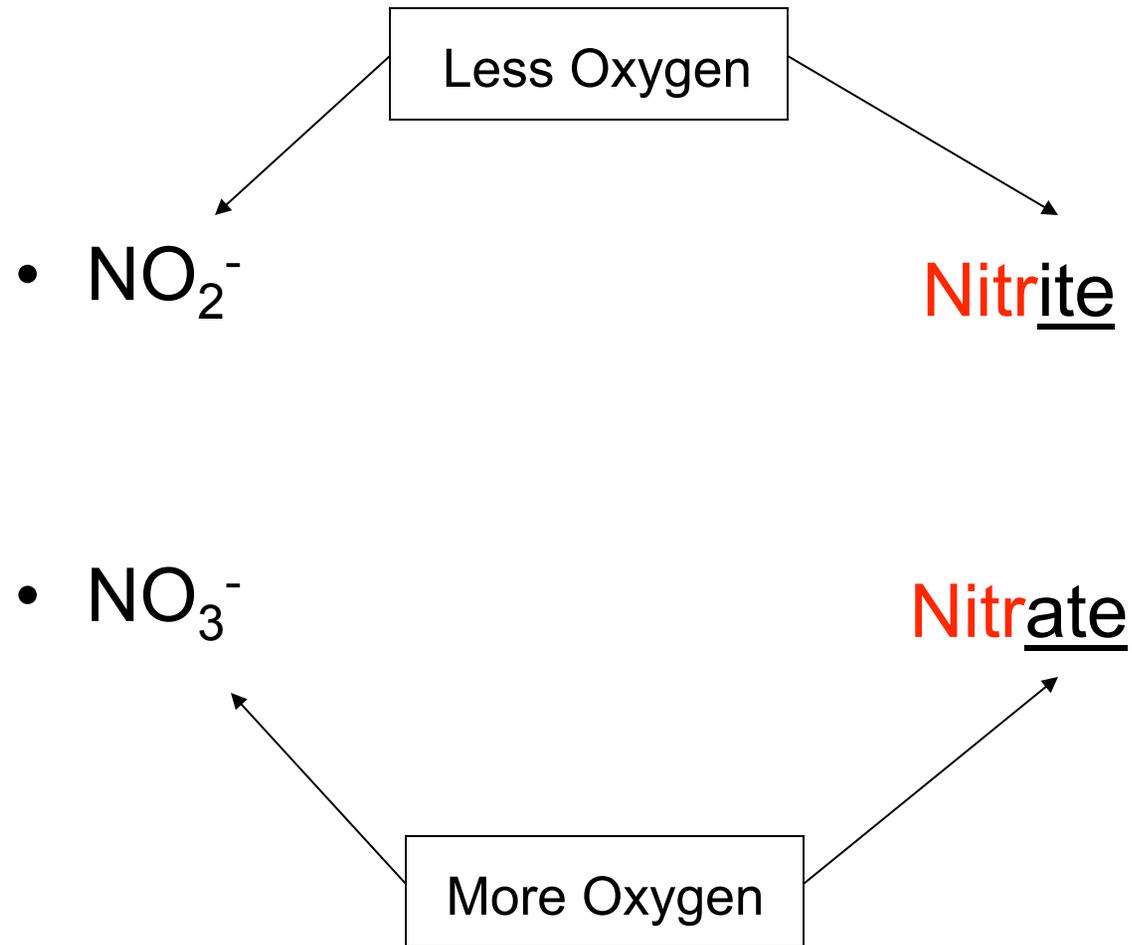
- Name the positive ion using the element's full name.
- Name the negative ion using the name of the group (polyatomic ion).

(Go to pg 224 for a table of common polyatomic ions)

Writing Ionic Formulas

Compound Name	Ions	Empirical Formula
strontium sulfide	Sr^{2+} S^{2-}	SrS
sodium nitride	Na^{1+} N^{3-}	Na_3N
calcium phosphide	Ca^{2+} P^{3-}	Ca_3P_2
barium nitrate	Ba^{2+} NO_3^{1-}	$\text{Ba}(\text{NO}_3)_2$

Oxyanions (Nitrogen and Oxygen)



Phosphorous and Oxygen

- PO_3^{3-} Phosphite
- PO_4^{3-} Phosphate

Oxyanions

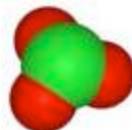
How are they different? How are they the same?



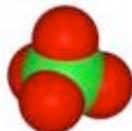
Hypochlorite



Chlorite



Chlorate



Perchlorate

Bromine and Oxygen

- BrO^- Hypobromite
- BrO_2^- Bromite
- BrO_3^- Bromate
- BrO_4^- Perbromate

Halogens can form FOUR different oxyanions

Naming Oxyanions

- **Oxyanion:** A polyatomic ion composed of an element bonded with one or more oxygen atoms.

Naming

- The prefix *hypo-* means one less oxygen atom than the *-ite* ion.
- The suffix *-ite* means one less oxygen atom than the *-ate* ion.
- The suffix *-ate* means one more oxygen atom than the *-ite* ion.
- The prefix *per-* means one more oxygen atom than the *-ate* ion.