

Lesson 5: Formula writing with ionic compounds

Review

- Ionic compounds are formed when a metal transfers one or more e⁻ to a nonmetal and the resulting ions combine to form a crystal lattice.

Rules for formula writing:

1. Determine the symbol and charge of the metal. You should use your ion sheet first and your periodic table if needed.
2. Determine the symbol and charge of the nonmetal.
3. Use the crossing-over technique to determine the ratio of metal to nonmetal.

Orally: Crossing-over is useful in determining the ratio of ions where the charges completely cancel. i.e., the positive charges and negative charges add to zero.

4. Reduce the formula if crossed-over charges have a common factor.

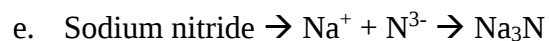
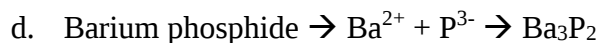
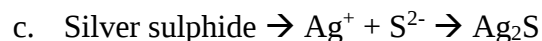
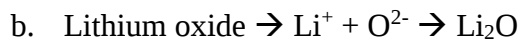
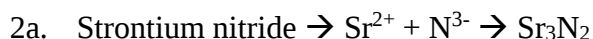
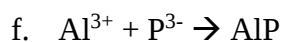
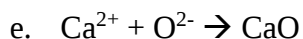
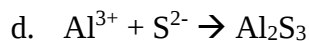
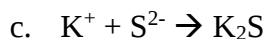
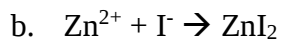
- **Orally:** Reducing is done because the ionic substance is a crystal lattice of indeterminate size. The formula simply represents the lowest whole number ratio of ions.

- Example: calcium fluoride $\text{Ca}^{2+} + \text{F}^{-} \rightarrow \text{CaF}_2$

- Example: calcium oxide $\text{Ca}^{2+} + \text{O}^{2-} \rightarrow \text{CaO}$

Note: When charges have equal magnitude but opposite sign the ions combine 1:1. You can still cross-over, but the subscripts must be reduced.

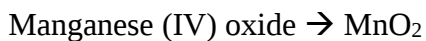
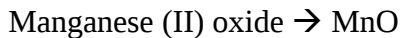
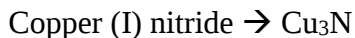
Practice with the crossing over technique



Multivalent Metals in Ionic Compounds

- When given the name of an ionic compound in which the metal has more than one charge that is possible, the ion charge being used is always identified by roman numerals in a bracket after the metal ion.
- Example: titanium (III) oxide: Indicates the charge of titanium is Ti^{+3}
iron (II) nitride: Indicates the charge on the iron is Fe^{+2}

Practice:



Polyatomic Ions

- A polyatomic ion is an ion made up of more than one type of atom joined by a covalent bond

- Example: CO_3^{2-} carbonate

PO_4^{3-} phosphate

NH_4^+ ammonium

- Example: calcium chromate = CaCrO_4

sodium sulphate = Na_2SO_4

cobalt (III) nitrite = $\text{Co}(\text{NO}_2)_3$

use brackets to show that multiple numbers of a polyatomic ion are required to balance the compound



Practice

Potassium permanganate $\rightarrow \text{KMnO}_4$

Sodium chromate $\rightarrow \text{Na}_2\text{CrO}_4$

Ammonium nitrate $\rightarrow \text{NH}_4\text{NO}_3$

Lead (II) perchlorate $\rightarrow \text{Pb}(\text{ClO}_4)_2$

Iron (II) hydrogen sulphide $\rightarrow \text{Fe}(\text{HS})_2$

Vanadium (V) cyanide $\rightarrow \text{V}(\text{CN})_5$

Homework: Worksheet on Ionic formula writing.