Binary Ionic Compounds of the Representative Elements
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The table on the next page shows most of the theoretically expected **binary ionic compounds** of the representative elements (s- and p-block). Rather than trying to memorize the formulas of these compounds, it is much easier to understand the patterns in the *subscripts* of the formulas.

In order to come up with the correct formula for the combination of any metal with any nonmetal, **first decide on the ion charges** expected for the positive ion (cation) and negative ion (anion). For the representative elements, this is easily predicted from the Group Number. Recall that metals always form positive ions, while nonmetals always form negative ions.

for Metals cations: positive charge = Group Number

e.g., **Ca** (Gr. 2A) forms $\mathbf{Ca^{+2}}$

for Nonmetal anions: negative charge = Group Number - 8

e.g., **P** (Gr. 5A) 5-8=-3, so forms $\mathbf{P^{-3}}$

After deciding the charges of the ions, **next figure out the ratio of cations-to-anions** that will give an electrically neutral binary ionic compound. In other words, figure out what *subscripts* are needed in the formula of the compound so that the charges of the positive and negative ions exactly cancel out. Deciding on the subscripts is very easy when a +1 or -1 ion is involved.

For binary combinations of positive and negative ions:

"the *charge* (without +/-) of the pos. ion becomes the *subscript* of the neg. anion, and vice-versa (then simplify the subscripts to the smallest whole number ratio)"

e.g., $\mathbf{(Ca^{+2})_3(P^{-3})_2}$ **or** $\mathbf{Ca_3P_2}$

NOTE: the positive charges of ions formed by transition metals (d- and f-blocks) are less predictable. For example, Fe commomnly forms both Fe^{+2} and Fe^{+3} ions, and Cu forms both Cu^{+1} and Cu^{+2} ions. However, if the cation charge of the transition metal is specified (this information would be given), then figuring out the cation-to-anion ratio is just as easy as in the case of positive ions of representative metals.

The table below lists the formulas of the binary ionic compounds of various combinations of representative metals and nonmetals. The formula for a specific combination appears at the intersection of the row and column containing the metal and nonmetal, respectively.

This table doesn't show all of the representative metal and nonmetal ions, but the ions not shown follow the same pattern as the other elements in the same Group (e.g. Li^{+1}, Na^{+1}, K^{+1}, Cs^{+1}, Fr^{+1}).

Charge of Ion	**-1** F^- Cl^- Br^- I^-	**-2** O^{-2} S^{-2}	**-3** N^{-3} P^{-3}	**-4** C^{-4}
+1 Li^+ Na^+ K^+	LiF, LiCl, LiBr, LiI NaF, NaCl, NaBr, NaI KF, KCl, KBr, KI	Li_2O, Li_2S Na_2O, Na_2S K_2O, K_2S	Li_3N, Li_3P Na_3N, Na_3P K_3N, K_3P	Li_4C Na_4C K_4C
+2 Mg^{+2} Ca^{+2} Sr^{+2}	MgF_2, $MgCl_2$, $MgBr_2$, MgI_2 CaF_2, $CaCl_2$, $CaBr_2$, CaI_2 SrF_2, $SrCl_2$, $SrBr_2$, SrI_2	MgO, MgS CaO, CaS SrO, SrS	Mg_3N_2, Mg_3P_2 Ca_3N_2, Ca_3P_2 Sr_3N_2, Sr_3P_2	Mg_2C Ca_2C Sr_2C
+3 Al^{+3} Ga^{+3}	AlF_3, $AlCl_3$, $AlBr_3$, AlI_3 GaF_3, $GaCl_3$, $GaBr_3$, GaI_3	Al_2O_3, Al_2S_3 Ga_2O_3, Ga_2S_3	AlN, AlP GaN, GaP	Al_4C_3 Ga_4C_3