## Chemical Names \& Formulas

Chapter 9

## Quick Reminders (or brand new?)

- A compound is a chemical combination of two or more elements (like the pre-class ones).
- Subscripts indicate how many atoms of an element are present.
- $\mathrm{H}_{2} \mathrm{O}=2$ Hydrogen, 1 Oxygen
- $\mathrm{CO}_{2}=1$ Carbon, 2 Oxygen
- Note that subscripts only apply to the letter next to them (unless there are parentheses).


## Quick Reminders (or brand new?)

- Chemists don't write ones.
- $\mathrm{Na}^{+}$has a charge of $1+$.
- $\mathrm{Cl}^{-}$has a charge of 1-.
- $\mathrm{K}_{2} \mathrm{~S}$ has one sulfur atom.


## Quick Reminders (or brand new?)

- For elements whose symbols have two letters (or even three), only the first letter is capitalized.
- For example, Cesium is abbreviated Cs.
- If you write CS, another person might think it's a compound of Carbon (C) and Sulfur (S).


## Review

- What is a cation?
- Which group of elements tend to form cations?
- What is an anion?
- Which group of elements tend to form anions?


## Cations and Anions

- And since cations and anions attract one another...
- They form ionic bonds, making ionic compounds.

"Perhaps one of you gentlemen would mind telling me just what it is outside the window that you find so attractive..?"


## Need to Know Information

- What kind of elements are involved?
- Metal, nonmetal, or metalloid.
- How many elements are there?
- 2 - binary compound
- 3 - ternary compound (usually has a polyatomic ion)
- What kind of charge does it create?
- Positive, negative, or neutral.
- Are there polyatomic ions?


## Predicting lonic Charges

## Alkali - Group 1A: Lose 1 electron to form 1+ions

$$
\begin{array}{llll}
\mathbf{H}^{+} & \mathrm{Li}^{+} & \mathrm{Na}^{+} & \mathrm{K}^{+}
\end{array}
$$

| 1 <br> 1.00794 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{Li}_{6941}^{3}$ |  |  |  |  |  |  |  |  |  |  |  | $\square$ |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | $\underset{\substack{14 \\ \mathrm{Si} \\ 28.0855}}{ }$ |  | ${\underset{32}{16}}_{S_{32} .066}$ | 17 <br> Cl <br> 35.4527 | $\begin{gathered} 18 \\ \mathrm{Ar} \\ 399.948 \end{gathered}$ |
|  | $\begin{gathered} 20 \\ \mathrm{Ca}_{40.078} \end{gathered}$ |  |  |  | $\stackrel{24}{\mathrm{Cr}}$ |  | $\begin{gathered} 26 \\ \mathrm{Fe} \\ 55845 \end{gathered}$ |  | $\stackrel{28}{\mathrm{Ni}}$ <br> 58.6934 | $\begin{gathered} 29 \\ \mathrm{Cu}_{63.546} \end{gathered}$ | $\begin{gathered} 30 \\ \mathrm{Zn} \\ 65.39 \end{gathered}$ | $\begin{gathered} 31 \\ \mathrm{Ga} \\ 69.723 \\ \hline \end{gathered}$ | $\begin{gathered} 32 \\ \mathrm{Ge} \\ \hline 72.61 \end{gathered}$ |  | $\begin{gathered} 34 \\ \mathrm{Se} \\ 78.96 \end{gathered}$ | $\begin{gathered} 35 \\ \mathrm{Br} \\ 79.904 \end{gathered}$ | $\underset{83.80}{36}$ |
| $\begin{gathered} \hline 37 \\ \mathrm{Rb}_{854678} \\ \hline \end{gathered}$ | $\begin{gathered} \hline 38 \\ \mathrm{Sr}_{87.62} \\ \hline \end{gathered}$ | 88.90585 <br> Y | $\begin{gathered} { }^{40} \\ \mathrm{Zr} \\ 91.224 \end{gathered}$ |  | $\begin{gathered} 42 \\ \mathrm{Mo} \\ 95.94 \end{gathered}$ | $\begin{aligned} & \hline 43 \\ & \mathrm{Tc} \\ & \text { (98) } \end{aligned}$ | $\begin{gathered} 44 \\ \mathrm{Ru} \\ 101.07 \end{gathered}$ |  | ${ }^{46}$ Pd 106.42 |  |  | $\operatorname{In}_{114.818}^{49}$ |  | $\begin{gathered} \hline 51 \\ \mathrm{Sb} \\ 121.760 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 52 \\ \mathrm{Te}_{127.60} \\ \hline \end{gathered}$ | 53 <br> $I$ <br> 126.90447 | $\begin{gathered} 54 \\ \mathrm{Xe} \\ 131.29 \end{gathered}$ |
|  |  | $\begin{gathered} \mathrm{La}_{138.9055}^{57} \end{gathered}$ | $\begin{gathered} 72 \\ \mathrm{Hf} \\ 178.49 \end{gathered}$ |  | $\begin{gathered} 74 \\ \mathrm{~W} \\ 183.84 \end{gathered}$ | $\begin{array}{\|c\|} \hline 75 \\ \mathrm{Re} \\ 186.207 \end{array}$ | $\begin{gathered} 76 \\ \text { OS } \\ 150.23 \end{gathered}$ |  | $\begin{gathered} 78 \\ \mathrm{Pt} \\ 195.078 \end{gathered}$ |  | $\begin{gathered} 80 \\ \mathrm{Hg} \\ 200.59 \end{gathered}$ |  | $\begin{gathered} 82 \\ \mathrm{~Pb} \\ 207.2 \end{gathered}$ | Bi <br> 208.58038 | $\begin{gathered} 84 \\ \mathrm{PO}_{\mathrm{O}} \\ (209) \end{gathered}$ | $\begin{gathered} 85 \\ \mathrm{At} \\ (210) \end{gathered}$ | $\begin{gathered} 86 \\ \mathrm{Rn} \\ (222) \end{gathered}$ |
| $\begin{gathered} 87 \\ \mathrm{Fr} \\ (223) \end{gathered}$ | $\begin{gathered} \hline 88 \\ \mathrm{Ra} \\ (226) \\ \hline \end{gathered}$ | $\begin{gathered} 89 \\ \mathrm{Ac} \\ (227) \\ \hline \end{gathered}$ | $\begin{array}{r} 104 \\ \mathrm{Rf} \\ (261) \end{array}$ | $\begin{gathered} 105 \\ \mathrm{Db} \\ (262) \end{gathered}$ | $\begin{gathered} 106 \\ \mathrm{Sg} \\ (265) \end{gathered}$ | $\begin{aligned} & 107 \\ & \mathrm{Bh} \\ & (262) \end{aligned}$ |  | $\begin{gathered} \hline 109 \\ \mathrm{Mt} \\ (266) \\ \hline \end{gathered}$ | $\begin{array}{r} 110 \\ (2099) \end{array}$ | $\begin{array}{r} 111 \\ (272) \\ \hline \end{array}$ | $\begin{aligned} & 112 \\ & (277) \\ & \hline \end{aligned}$ |  | $\begin{gathered} 114 \\ (289) \\ (287) \\ \hline \end{gathered}$ |  | $\begin{gathered} 116 \\ (289) \\ \hline \end{gathered}$ |  |  |

## Predicting Ionic Charges

## Alkaline Earth - Group 2A: Loses 2 electrons to form 2+ ions

$\begin{array}{lllll}\mathrm{Be}^{2+} & \mathbf{M g}^{2+} & \mathrm{Ca}^{2+} & \mathrm{Sr}^{2+} & \mathrm{Ba}^{2+}\end{array}$

| 1 <br> $\stackrel{1}{H}$ <br> 1.00794 <br> 3 | $\downarrow$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| $\begin{gathered} \mathrm{Li}_{6.941}^{3} \\ \hline \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  | 5 B 10.811 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | $\qquad$ | $\begin{gathered} 14 \\ \mathrm{Si} \\ 28.0855 \\ \hline \end{gathered}$ | 15 <br> P <br> 3a973761 | $\mathrm{S}_{32.066}^{16}$ |  | $\begin{gathered} 18 \\ \mathrm{Ar} \\ 39.948 \\ \hline \end{gathered}$ |
|  | $\begin{aligned} & 20 \\ & \mathrm{Ca} \\ & 40.078 \end{aligned}$ |  | $\begin{gathered} 22 \\ \mathrm{Ti} \\ 47.867 \end{gathered}$ | $\begin{gathered} 23 \\ \mathrm{~V} \\ 50.9415 \end{gathered}$ | $\underset{51.9961}{24}$ |  | $\begin{gathered} 26 \\ \mathrm{Fe} \\ 55.845 \end{gathered}$ |  | $\stackrel{28}{\mathrm{Ni}_{58.0834}}$ | $\begin{gathered} 29 \\ \mathrm{Cu} \\ 63.546 \end{gathered}$ | $\begin{aligned} & 30 \\ & 7 n \\ & 65.39 \end{aligned}$ | $\begin{gathered} 31 \\ \text { Ga } \\ 9.723 \\ \hline \end{gathered}$ | $\begin{gathered} 32 \\ \text { Ge } \\ 72.61 \\ \hline \end{gathered}$ |  | $\begin{gathered} 34 \\ \mathrm{Se} \\ 78.96 \end{gathered}$ | $\begin{gathered} 35 \\ \mathrm{Br} \\ 79.904 \end{gathered}$ | $\underset{83.80}{36}$ |
| $\begin{gathered} \hline 37 \\ \mathrm{Rb} \\ 854678 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 38 \\ \mathrm{Sr} \\ 87.62 \end{gathered}$ |  | $\begin{gathered} 4_{40} \\ \mathrm{Zr} \\ 91.224 \end{gathered}$ |  | $\begin{gathered} 42 \\ \mathrm{Mo} \\ 95.94 \end{gathered}$ | $\begin{aligned} & \hline 43 \\ & \mathrm{Tc} \\ & \hline(98) \\ & \hline \end{aligned}$ | $\begin{gathered} 44 \\ \mathrm{Ru} \\ 101.07 \\ \hline \end{gathered}$ | $\square$ | $\begin{gathered} 46 \\ \mathrm{Pd} \\ 106.42 \end{gathered}$ |  | 48 Cd 112.411 | $\operatorname{In}_{114.818}^{49}$ |  | $\begin{array}{\|c\|} \hline 51 \\ \mathrm{Sb} \\ 121.760 \\ \hline \end{array}$ | $\begin{gathered} \hline 52 \\ \mathrm{Te} \\ 127.60 \\ \hline \end{gathered}$ | 53 $I$ 126.90447 | $\begin{gathered} 54 \\ \mathrm{Xe} \\ 131.29 \end{gathered}$ |
|  | 56 <br> Ba <br> 137.327 | 138 <br> $L_{13}^{57}$ | $\begin{gathered} 72 \\ \mathrm{Hf} \\ 178.49 \\ \hline \end{gathered}$ |  | $\begin{gathered} 74 \\ \mathrm{~W} \\ 183.84 \\ \hline \end{gathered}$ |  | $\begin{gathered} \hline 76 \\ \text { OS } \\ 150.23 \end{gathered}$ | $\begin{gathered} 77 \\ \mathrm{Ir} \\ 192.217 \end{gathered}$ |  |  | $\begin{gathered} 80 \\ \mathrm{Hg} \\ 200.59 \end{gathered}$ |  | $\begin{array}{r} 82 \\ \mathrm{~Pb} \\ 207.2 \\ \hline \end{array}$ | 83 <br> Bi <br> 208.58038 | $\begin{gathered} 84 \\ \mathrm{PO}_{\mathrm{O}} \\ (208) \\ \hline \end{gathered}$ | $\begin{gathered} 85 \\ \mathrm{At} \\ (210) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 86 \\ \mathrm{Rn} \\ (222) \\ \hline \end{gathered}$ |
| $\begin{gathered} 87 \\ \mathrm{~F}_{(223)} \end{gathered}$ | $\begin{gathered} 88 \\ \mathrm{Ra} \\ (226) \end{gathered}$ | $\begin{gathered} 89 \\ \mathrm{Ac} \\ (227) \end{gathered}$ | $\begin{array}{r} 104 \\ \mathrm{Rf} \\ (261) \end{array}$ | $\begin{gathered} 105 \\ \mathrm{Db} \\ (262) \end{gathered}$ | $\begin{gathered} 106 \\ \mathrm{Sg} \\ (20.3) \\ \hline \end{gathered}$ | $\begin{aligned} & 107 \\ & \text { Bh } \\ & (262) \end{aligned}$ |  | $\begin{aligned} & \hline 109 \\ & \mathrm{Mt} \\ & (266) \\ & \hline \end{aligned}$ | $\begin{aligned} & 110 \\ & (269) \\ & \hline \end{aligned}$ | $\begin{gathered} 111 \\ (272) \\ \hline \end{gathered}$ | $\begin{array}{r} 112 \\ (277) \\ \hline \end{array}$ |  | $\begin{gathered} 114 \\ (289) \\ (287) \\ \hline \end{gathered}$ |  | $\begin{gathered} 116 \\ (289) \\ \hline \end{gathered}$ |  |  |

## Predicting Ionic Charges

## Group 3A: Loses 3

electrons to form 3+ions

| 1 <br> H <br> 1.00794 <br> 3 |  |  |  |  |  |  |  |  |  |  |  | $2$ |  |  |  |  |  |
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| $\mathrm{Li}_{6941}^{3}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\stackrel{8}{\mathrm{O}}$ |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} \hline 14 \\ \mathrm{Si} \\ 28.0855 \\ \hline \end{gathered}$ | 15 <br> P <br> 3a973761 | $\mathrm{S}_{32.066}^{16}$ |  | $\begin{gathered} 18 \\ \mathrm{Ar} \\ 39.948 \\ \hline \end{gathered}$ |
|  | $\begin{aligned} & 20 \\ & \mathrm{Ca} \\ & 40.078 \end{aligned}$ |  | $\begin{gathered} 22 \\ \mathrm{Ti} \\ 47.867 \end{gathered}$ | $\begin{gathered} 23 \\ \mathrm{~V} \\ 50.9415 \end{gathered}$ | $\underset{51.9961}{24}$ |  | $\begin{gathered} 26 \\ \mathrm{Fe} \\ 55.845 \end{gathered}$ |  | $\stackrel{28}{\mathrm{Ni}_{58.0834}}$ | $\begin{gathered} 29 \\ \mathrm{Cu} \\ 63.546 \end{gathered}$ | $\begin{aligned} & 30 \\ & 7 n \\ & 65.39 \end{aligned}$ | $\begin{gathered} 31 \\ \text { Ga } \\ 9.723 \\ \hline \end{gathered}$ | $\begin{gathered} 32 \\ \text { Ge } \\ 72.61 \\ \hline \end{gathered}$ |  | $\begin{gathered} 34 \\ \mathrm{Se} \\ 78.96 \end{gathered}$ | $\begin{gathered} 35 \\ \mathrm{Br} \\ 79.904 \end{gathered}$ | $\underset{83.80}{36}$ |
| $\begin{gathered} \hline 37 \\ \mathrm{Rb} \\ 854678 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 38 \\ \mathrm{Sr} \\ 87.62 \end{gathered}$ |  | ${ }^{40}$ 7 Zr 91.224 |  | $\begin{gathered} 42 \\ \mathrm{Mo} \\ 95.94 \end{gathered}$ | $\begin{aligned} & \hline 43 \\ & \mathrm{Tc} \\ & \hline(98) \\ & \hline \end{aligned}$ | $\begin{gathered} 44 \\ \mathrm{Ru} \\ 101.07 \\ \hline \end{gathered}$ |  | $\begin{gathered} 46 \\ \mathrm{Pd} \\ 106.42 \end{gathered}$ |  | $\mathrm{Cd}_{18}^{48}$ <br> 112.411 | $\operatorname{In}_{114.818}^{49}$ |  | $\begin{array}{\|c\|} \hline 51 \\ \mathrm{Sb} \\ 121.760 \\ \hline \end{array}$ | $\begin{gathered} \hline 52 \\ \mathrm{Te} \\ 127.60 \\ \hline \end{gathered}$ | 53 $I$ 126.90447 | $\begin{gathered} 54 \\ \mathrm{Xe} \\ 131.29 \end{gathered}$ |
|  |  | $\square$ | $\begin{gathered} 72 \\ \mathrm{Hf} \\ 178.49 \end{gathered}$ |  | $\begin{gathered} 74 \\ \mathrm{~W} \\ 183.84 \\ \hline \end{gathered}$ | $\begin{array}{\|c\|} \hline 75 \\ \mathrm{Re} \\ 186.207 \end{array}$ | $\begin{gathered} \hline 76 \\ \text { OS } \\ 150.23 \end{gathered}$ |  |  |  | $\begin{gathered} 80 \\ \mathrm{Hg} \\ 200.59 \end{gathered}$ |  | $\begin{gathered} 82 \\ \mathrm{~Pb} \\ 207.2 \\ \hline \end{gathered}$ | 83 <br> Bi <br> 208.58038 | $\begin{gathered} 84 \\ \mathrm{PO}_{\mathrm{O}} \\ (208) \\ \hline \end{gathered}$ | $\begin{gathered} 85 \\ \mathrm{At} \\ (210) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 86 \\ \mathrm{Rn} \\ (222) \\ \hline \end{gathered}$ |
| $\begin{gathered} 87 \\ { }^{87} \\ \mathrm{Fr} \\ (223) \end{gathered}$ | $\begin{gathered} 88 \\ \mathrm{Ra} \\ (226) \end{gathered}$ | $\begin{gathered} 89 \\ \mathrm{Ac} \\ (227) \\ \hline \end{gathered}$ | $\begin{aligned} & 104 \\ & \mathrm{Rf} \\ & (261) \end{aligned}$ | $\begin{gathered} 105 \\ \mathrm{Db} \\ (262) \end{gathered}$ | $\begin{gathered} 106 \\ \mathrm{Sg} \\ (20.3) \\ \hline \end{gathered}$ | $\begin{aligned} & 107 \\ & \text { Bh } \\ & (262) \end{aligned}$ |  | $\begin{aligned} & \hline 109 \\ & \mathrm{Mt} \\ & (266) \\ & \hline \end{aligned}$ | $\begin{aligned} & 110 \\ & (269) \\ & \hline \end{aligned}$ | $\begin{gathered} 111 \\ (272) \\ \hline \end{gathered}$ | $\begin{array}{r} 112 \\ (277) \\ \hline \end{array}$ |  | $\begin{gathered} 114 \\ (289) \\ (287) \\ \hline \end{gathered}$ |  | $\begin{gathered} 116 \\ (289) \\ \hline \end{gathered}$ |  |  |

## Predicting lonic Charges

Neither! Group 4A elements rarely form ions.

Group 4A: Lose 4
electrons or gain 4 electrons?


## Predicting lonic Charges

$\mathrm{N}^{-}$Nitride
P3- Phosphide
As ${ }^{3-}$ Arsenide

Group 5A: Gains 3 electrons to form 3 -ions

| $\begin{gathered} \hline 1 \\ \mathrm{H} \\ 1.00794 \\ \hline \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| $\underset{6.941}{L^{3}}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} 14 \\ \mathrm{Si} \\ 28.0858 \\ \hline \end{gathered}$ | 15 <br> P <br> $\mathbf{P} 97361$ | $\begin{gathered} 16 \\ S \\ 32.066 \end{gathered}$ |  | $\underset{39.948}{\mathrm{Ar}}$ |
|  | $\begin{gathered} 20 \\ \mathrm{Ca} \\ 40.078 \end{gathered}$ |  | $\begin{gathered} 22 \\ \mathrm{Ti}_{47.86} \\ \hline \end{gathered}$ | $\begin{gathered} 23 \\ \mathrm{~V} \\ 50.9415 \end{gathered}$ | $\stackrel{24}{\mathrm{Cr}}$ |  | $\begin{gathered} 26 \\ \mathrm{Fe} \\ 55.845 \end{gathered}$ |  | $\underset{58.6834}{28}$ | $\begin{gathered} 29 \\ \mathrm{Cu} \\ 63.546 \end{gathered}$ | $\begin{aligned} & 30 \\ & 7 n \\ & 65.39 \end{aligned}$ | $\begin{gathered} 31 \\ \text { Ga } \\ \omega 9.723 \end{gathered}$ | $\begin{gathered} 32 \\ \mathrm{Ge} \\ 72.61 \\ \hline \end{gathered}$ |  | $\begin{aligned} & \hline 34 \\ & \mathrm{Se} \\ & 78.96 \\ & \hline \end{aligned}$ | $\begin{gathered} 35 \\ \mathrm{Br} \\ 79.904 \end{gathered}$ | $\begin{aligned} & 366 \\ & \mathrm{Kr} \\ & 81.80 \end{aligned}$ |
| $\begin{gathered} 37 \\ \mathrm{Rb}_{854678} \end{gathered}$ | $\begin{gathered} \hline 38 \\ \mathrm{Sr}_{8} \\ 87.62 \\ \hline \end{gathered}$ | 39 Y .90585 | $\begin{gathered} 4_{10} \\ \mathrm{Zr}^{91.224} \end{gathered}$ |  | $\begin{gathered} 42 \\ \mathrm{Mo} \\ 95.94 \end{gathered}$ | $\begin{aligned} & \hline 43 \\ & \mathrm{Tc} \\ & \hline(98) \\ & \hline \end{aligned}$ | $\begin{gathered} 44 \\ \mathrm{Ru} \\ 101.07 \end{gathered}$ |  | $\begin{gathered} 46 \\ \mathrm{Pd} \\ 106.42 \end{gathered}$ |  | 48 <br> $\mathrm{Cd}_{12.411}$ | $\operatorname{In}_{114.818}^{49}$ |  | 51 <br> $\mathrm{Sb}_{121.760}^{5}$ <br> 8 | $\begin{gathered} \hline 52 \\ \mathrm{Te} \\ 127.60 \\ \hline \end{gathered}$ | 53 $I$ 126.90447 | $\begin{array}{r} \hline 54 \\ \mathrm{Xe} \\ 131.29 \\ \hline \end{array}$ |
|  |  | ${\underset{138.9055}{57}}^{\text {La }}$ | $\begin{gathered} 72 \\ \mathrm{Hf} \\ 178.49 \\ \hline \end{gathered}$ |  | $\begin{gathered} 74 \\ \mathrm{~W} \\ 183.84 \\ \hline \end{gathered}$ |  | $\begin{gathered} 76 \\ \mathrm{OS} \\ 150.23 \end{gathered}$ | $\begin{gathered} 77 \\ \mathrm{Ir}_{192.217} \end{gathered}$ |  |  | $\begin{gathered} 80 \\ \mathrm{Hg}_{200.59} \end{gathered}$ |  | $\begin{array}{r} 82 \\ \mathrm{~Pb} \\ 207.2 \\ \hline \end{array}$ | 83 <br> $208, ~ c g 038$ <br> Bi | $\begin{gathered} 84 \\ \mathrm{P}_{\mathrm{O}} \\ (209) \\ \hline \end{gathered}$ | $\begin{gathered} 85 \\ \mathrm{At} \\ (210) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 86 \\ \mathrm{Rn} \\ (222) \\ \hline \end{gathered}$ |
| $\begin{gathered} 87 \\ \mathrm{Fr} \\ (223) \end{gathered}$ | 88 Ra (226) | $\begin{gathered} 89 \\ \mathrm{Ac} \\ (227) \end{gathered}$ | $\begin{array}{r} 104 \\ \mathrm{Rf} \\ (261) \end{array}$ | $\begin{gathered} 105 \\ \mathrm{Db} \\ (262) \end{gathered}$ | $\begin{gathered} 106 \\ \mathrm{Sg} \\ (26 \mathrm{~g}) \end{gathered}$ | $\begin{aligned} & 107 \\ & \mathrm{Bh} \\ & (262) \end{aligned}$ | 108 Hs $(265)$ | 109 <br> Mt <br> (266) | $\begin{array}{r} 110 \\ (209) \\ \hline \end{array}$ | $\begin{array}{r} 111 \\ (272) \\ \hline \end{array}$ | $\begin{array}{r} 112 \\ (277) \\ \hline \end{array}$ |  | $\begin{gathered} 114 \\ (289) \\ (287) \\ \hline \end{gathered}$ |  | $\begin{gathered} 116 \\ (289) \\ \hline \end{gathered}$ |  |  |

## Predicting Ionic Charges

# $\mathrm{O}^{2-}$ Oxide <br> S $^{2-}$ Sulfide <br> Se $^{2-} \quad$ Selenide <br> Group 6A：Gains 2 electrons to form <br> 2－ions 

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| ${ }^{\text {magm }}$ |  |  |  |  |  |  |  |  |  | $\cdots$ | S | ${ }^{\text {P }}$ |  |  |  |
| 鰝 | \％ |  |  | 5 |  |  |  | \％ | 炒 | ${ }_{\text {ca }}$ | $\stackrel{\circ}{\circ}$ | 2 |  |  | ${ }_{\text {kr }}^{\text {kr }}$ |
| 为 ${ }^{\text {chi }}$ | \％ | 动 | \％ | T | ${ }^{\text {R }}$ | Ril | ${ }_{\text {pid }}^{\text {Pd }}$ | ${ }^{\circ} \mathrm{A}$ | cid | in | sn | st |  |  |  |
| ${ }_{\text {cs }}{ }^{\circ}{ }^{\circ}$ | H | ${ }_{\text {it }}$ | ${ }^{2}$ | ${ }^{\text {R }}$ | \％ | R | ${ }^{\text {pi }}$ | ${ }^{\text {an }}$ | ${ }^{4}$ | － | pn | ${ }^{\text {B }}$ |  |  |  |
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## Predicting Ionic Charges

## Halogens

F1- $^{-1}$ Fluoride
Group 7A: Gains 1 electron to form
Cl¹- Chloride $\mathrm{Br}^{1-}$ Bromide

| ${ }^{\text {H }}$ | $\mathrm{Br}^{1-}$$\mathrm{I}^{1-}$ |  | Bromide |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  | dos |  |  |  |  |  |  |
| ${ }^{\text {Rb }}$ St | y | ${ }^{\circ} \mathrm{A}$ Nib | Mัo |  |  |  | ${ }^{4} \mathrm{~A}$ |  |  |  |  |  |  |
|  | La | ${ }_{\text {\% }}^{\text {Ta }}$ | \% | \% | ${ }_{0}^{\circ} \mathrm{c}$ | ${ }_{\text {c }}$ | hin | ${ }^{\text {H2m }}$ | II |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Predicting Ionic Charges

## Group 8A: Stable Noble gases do not form ions!

| $\begin{gathered} \stackrel{1}{H} \\ 1.00794 \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | ${ }_{4.002602}^{2}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{L}_{6.941}^{3}$ | $\begin{aligned} & 4 \\ & \mathrm{Be} \\ & 9.012182 \end{aligned}$ |  |  |  |  |  |  |  |  |  |  | 5 <br> B <br> 10.811 | $\stackrel{6}{C}_{12.0107}$ | $\mathrm{N}^{7}$ 14.00674 | $\begin{gathered} 8 \\ \bigcirc_{15.9994}^{0} \end{gathered}$ | 9 F 18.998403 | 10 <br> Ne <br> 20.1797 |
| $\begin{array}{\|c} \hline 11 \\ \mathrm{Na} \\ 22.989770 \end{array}$ | $\begin{array}{\|c} 12 \\ \mathrm{M} \mathrm{~g}_{2} \\ \hline \end{array}$ |  |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} 14 \\ \mathrm{Si} \\ 28.0855 \end{gathered}$ | 15 P 30973761 | $\begin{gathered} 16 \\ S_{32.066} \end{gathered}$ | $\stackrel{17}{C_{35.4527}}$ | $\begin{gathered} 18 \\ \mathrm{Ar} \\ 39.948 \\ \hline \end{gathered}$ |
| $\mathrm{K}_{39}^{19}$ | $C_{4}^{20}$ | $\begin{array}{\|c\|} \hline 21 \\ \mathrm{~S} \mathrm{C} \\ 44.955910 \end{array}$ | $T_{47.867}^{22}$ | $\begin{gathered} 23 \\ \mathrm{~V} \\ 50.9415 \end{gathered}$ | ${ }_{51.9961}^{24}$ | 25 <br> Mn <br> 54.938049 | $\begin{gathered} 26 \\ \mathrm{Fe} \\ 55.845 \end{gathered}$ |  | $\stackrel{28}{\mathrm{Ni}}$ | $\mathrm{Cu}_{63.546}^{29}$ | $\begin{gathered} 30 \\ Z n \\ 65.39 \end{gathered}$ | $\begin{gathered} 31 \\ \text { Ca } \\ 69.723 \end{gathered}$ | $\stackrel{32}{\text { Ge }}$ | $\begin{gathered} 33 \\ \mathrm{AS} \\ 74.92160 \end{gathered}$ | $\begin{gathered} 34 \\ \mathrm{Se} \\ 78.96 \end{gathered}$ | $\begin{gathered} 35 \\ \mathrm{Br} \\ 79.904 \end{gathered}$ | $\mathrm{Kr}_{81.80}^{36}$ |
| $\begin{aligned} & 37 \\ & \mathrm{Rb} \\ & 85.4678 \end{aligned}$ | $\stackrel{38}{\mathrm{Si}}$ | 39 Y 88.90585 | $\begin{gathered} 40 \\ 7 r \\ 91.224 \end{gathered}$ | 41 Nb 92.90638 | $\begin{gathered} 42 \\ \mathrm{MO} \\ 95.94 \end{gathered}$ | ${ }_{(98)}^{43}$ | $\begin{gathered} 44 \\ \mathrm{Ru} \\ 101.07 \end{gathered}$ | 45 Rh 102.50550 | $\begin{aligned} & 46 \\ & \mathrm{Pd} \\ & 106.42 \end{aligned}$ | $\begin{gathered} 47 \\ \mathrm{~A} \mathrm{O} \\ 107.8682 \end{gathered}$ | $\begin{gathered} 48 \\ \mathrm{Cd}_{112.411} \end{gathered}$ | $\operatorname{In}_{114.818}^{49}$ | $\begin{gathered} 50 \\ \mathrm{Sn} \\ 118.710 \end{gathered}$ | $\begin{gathered} 51 \\ \mathrm{Sb} \\ 121.760 \end{gathered}$ | $\begin{gathered} 52 \\ \text { Te } \\ 127.60 \end{gathered}$ |  | $\begin{gathered} \hline 54 \\ \mathrm{Xe} \\ 131.29 \end{gathered}$ |
| $\begin{gathered} 55 \\ \mathrm{CS} \\ 132.90545 \end{gathered}$ | 56 Ba 137.327 | $\begin{gathered} \hline 57 \\ 138.9055 \end{gathered}$ | $\begin{gathered} 72 \\ \mathrm{Hf} \\ 178.49 \end{gathered}$ | 73 Ta 180.9479 | $\begin{gathered} 74 \\ \mathrm{~W} \\ 183.84 \end{gathered}$ | $\begin{gathered} 75 \\ \mathrm{Re} \\ 186.207 \end{gathered}$ | $\begin{gathered} \hline 76 \\ \mathrm{OS} \\ 150.23 \end{gathered}$ | $\begin{gathered} 77 \\ \operatorname{Ir} \\ 192.217 \end{gathered}$ | $\begin{gathered} 78 \\ \mathrm{Pt} \\ 195.078 \end{gathered}$ | 79 Au 196.96655 | $\begin{gathered} 80 \\ \mathrm{Hg} \\ 200.59 \end{gathered}$ | 81 Tl 204.3833 | $\begin{gathered} 82 \\ \mathrm{~Pb} \\ 207.2 \end{gathered}$ | 83 <br> Bi <br> 208.98038 | $\begin{gathered} 84 \\ \mathrm{PO} \\ (209) \end{gathered}$ | $\begin{gathered} 85 \\ \mathrm{At} \\ (210) \end{gathered}$ | $\begin{gathered} 86 \\ \mathrm{Rn} \\ \Omega 22) \end{gathered}$ |
| $\begin{aligned} & 87 \\ & \mathrm{~F} \mathrm{r} 23 \end{aligned}$ | $\begin{gathered} 88 \\ \mathrm{Ra} \\ (226) \end{gathered}$ | $\begin{gathered} 89 \\ \mathrm{AC} \\ (227) \end{gathered}$ | $\begin{array}{r} 104 \\ \mathrm{Rf} \\ (261) \end{array}$ | $\begin{gathered} 105 \\ \mathrm{Db} \\ (262) \end{gathered}$ | $\begin{gathered} 106 \\ \mathrm{SO} \\ (265) \end{gathered}$ | $\begin{aligned} & 107 \\ & \mathrm{Bh} \\ & (262) \end{aligned}$ | $\begin{gathered} 108 \\ \mathrm{HS} \\ (265) \end{gathered}$ | $\begin{aligned} & 109 \\ & \mathrm{Mt} \\ & (266) \end{aligned}$ | $\begin{gathered} 110 \\ (2099) \end{gathered}$ | $\begin{gathered} 111 \\ (272) \\ \hline \end{gathered}$ | $\begin{array}{r} 112 \\ (277) \\ \hline \end{array}$ |  | $\begin{gathered} 114 \\ (289) \\ (287) \end{gathered}$ |  | $\begin{gathered} 116 \\ (289) \end{gathered}$ |  |  |

## Predicting Ionic Charges

## Groups 1B-8B: Many transition elements

 hàve more than one possible oxidation $\operatorname{Iron}(\mathrm{II})=\mathrm{Fe}^{2+}$
## Common Multivalent Elements

- Copper ( Cu ) - either 1 or 2 valence electrons. - Copper (I) or Copper (II) $-1^{+}$or $2^{+}$
- Nickel (Ni) - either 2 or 3 valence electrons. - Nickel (II) or Nickel (III) $-2^{+}$or $3^{+}$
- Iron (Fe) - either 2 or 3 valence electrons. - Iron (II) or Iron (III) - $2^{+}$or $3^{+}$
- Lead (Pb) - either 2 or 4 valence electrons. - Lead (II) or Lead (IV) $-2^{+}$or $4^{+}$
- Tin (Sn) - either 2 or 4 valence electrons. ${ }^{\square}$ Tin (II) or Tin (IV) $-2^{+}$or $4^{+}$
- Mercury (Hg) - either 1 or 2 valence electrons.
- Mercury (I) or Mercury (II) - $1^{+}$or $2^{+}$


## Predicting Ionic Charges

Groups 1B-8B: Some transition elements
have only one possible oxidation state.

## Zinc $=\mathrm{Zn}^{2+}$

| $\stackrel{1}{\mathrm{H}}$ |  |
| :---: | :---: |
| ${ }^{3}$ | 4 |
| Li | Be |
| 6941 | 9.012182 |
| 11 | 12 |
| Na | Mg |
| 22.989770 | 24.3050 |
| 19 | 20 |
| K | Ca |
| 39,.983 | 40.078 |
| 37 | ${ }^{38}$ |
| Rb | Sr |
| 85.4678 | 87.62 |
| 55 | 56 |
| Cs | Ba |
| 13290545 | 137.327 |
| 87 | ${ }^{88}$ |
| Fr | Ra |
| (223) | (226) |



Silver $=\mathrm{Ag}^{+}$
Nickel $=\mathrm{Ni}^{2+}$
(227) $\quad \underset{(261)}{R 1}$
(262)

## Binary Ionic Compounds

- What does binary mean?
- Two
- Contains 2 elements
- What is an ionic compound?
- Formed between a metal and a nonmetal

\section*{Binary Ionic Compou <br> <br> \section*{Example <br> <br> \section*{Example <br> <br> Potassium and Fluorine}}

- Elements to Formulas
- Identify cation/anion (with charges)
- Roman numerals for transition \& other multivalent metals!


## Cation - K ${ }^{+}$

## Anion- $\mathrm{F}^{-}$

- Put the cation symbol first, then the anion

$$
\mathbf{K}^{+} \mathbf{F}^{-}
$$

- Drop \& Cross to balance charges

KF

## Binary Ionic Compounds Practice

- Calcium and Bromine
- Copper(II) and Oxygen
- Lithium and Sulfur
- Mercury(I) and Oxygen
- Aluminum and Chlorine
- Lead(IV) and Sulfur
- Potassium and Sulfur
- Beryllium and Bromine
- Cobalt(II) and Phosphorus
- Tin(IV) and Chlorine


## Binary Ionic Compounds

- Formulas to Names


## Example

- Write the name of the cation (Roman numerals with multivalent transition metals)


## $\mathbf{K}^{+}$- Potassium

- Write the name of the anion
- Drop the ending
- Add -ide


## $\mathrm{F}^{-}$- Fluorine becomes Fluoride

- Combine cation then anion

Potassium fluoride

## Binary Ionic Compounds Practice

- $\mathrm{CaBr}_{2}$
- $\mathrm{Hg}_{2} \mathrm{O}$
- NaCl
- $\mathrm{CoCl}_{2}$
- $\mathrm{AlCl}_{3}$
- $\mathrm{K}_{2} \mathrm{~S}$
- $\mathrm{CrCl}_{2}$
- $\mathrm{Na}_{3} \mathrm{P}$


## Binary Ionic Compounde with Transition <br> Example <br> Iron(III) and Chlorine <br> - Elements to Formulas

- Identify cation/anion (with charges)

$$
\text { Cation }-\mathrm{Fe}^{3^{+}} \quad \text { Anion- } \mathbf{C l}^{-}
$$

- Put the cation symbol first, then the anion

$$
\mathrm{Fe}^{3+} \mathrm{Cl}^{-}
$$

- Drop \& Cross to balance charges
$\mathrm{FeCl}_{3}$

Binary Ionic Compounds Practice

- Copper(II) and Oxygen
- Mercury(I) and Oxygen
- Lead(IV) and Sulfur
- Cobalt(II) and Chlorine
- Tin(IV) and Chlorine
- Cobalt(III) and Iodine
- Silver and Bromine
- Chromium(II) and Chlorine


## Binary Ionic Compounds

with Transition Metals Example $\mathrm{FeCl}_{3}$

- Formulas to Names
- "Uncross" to find charge
- Write the name of the cation with roman numeral

$$
\mathbf{F e}^{3^{+}}-\operatorname{Iron}(\mathrm{III})
$$

- Write the name of the anion
- Drop the ending
- Add -ide


# $\mathrm{Cl}^{-}-$Chlorine becomes Chloride 

- Combine cation then anion


## Iron(III) Chloride

## Binary Ionic Compounds Practice

- $\mathrm{Hg}_{2} \mathrm{O}$
- CuO
- $\mathrm{Pb}_{2} \mathrm{~S}_{4}$
- $\mathrm{CoCl}_{2}$
- $\mathrm{SnCl}_{4}$
- $\mathrm{CoI}_{3}$
- AgBr
- $\mathrm{CrCl}_{2}$


## Compounds with Pol

## Example

## Sodium and Carbonate

- Elements/Polyatomics
- Identify cation/anion (with charges)
- Identify the polyatomic ion (with charges)


## Cation - $\mathbf{N a}^{1+}$

Negative Polyatomic - $\mathrm{CO}_{3}{ }^{2-}$

- Put the cation/positive polyatomic symbol first, then the anion/negative polyatomic

$$
\mathbf{N a}^{1+} \mathbf{C O}_{3}{ }^{2-}
$$

- Drop \& Cross to balance charges. Put polyatomics in ( ) if more than one.

$\mathrm{Na}_{2} \mathrm{CO}_{3}$

## Compounds with Polyatomics Practice

- Ammonium and Oxygen
- Potassium and Nitrate
- Lead(IV) and Dichromate
- Calcium and Hydroxide
- Lithium and Sulfate
- Calcium and Permanganate
- Sodium and Chlorate
- Magnesium and Phosphate


## Compounds with Polyatc

- Formulas to Names


## Example

 $\mathrm{Na}_{2} \mathrm{CO}_{3}$- Look for the polyatomic - it can be $1^{\text {st }}$ or $2^{\text {nd }}$
- "Uncross" to find charge
$\mathbf{N a}^{\mathbf{1 +}}$ - Sodium
$\mathrm{CO}_{3}{ }^{2-}$ - Carbonate
- Write the name
- If the polyatomic is $1^{\text {st }}$, end the anion with -ide
- If the polyatomic is $2^{\text {nd }}$, cation is written as normal and polyatomic is normal


## Sodium Carbonate

## Compounds with Polyatomics Practice

- $\mathrm{NH}_{4} \mathrm{Cl}$
- $\mathrm{KNO}_{3}$
- $\mathrm{Ca}(\mathrm{OH})_{2}$
- $\mathrm{Pb}\left(\mathrm{Cr}_{2} \mathrm{O}_{7}\right)_{2}$
- $\mathrm{Li}_{2} \mathrm{SO}_{4}$
- $\mathrm{Ca}\left(\mathrm{MnO}_{4}\right)_{2}$
- $\mathrm{NaClO}_{3}$
$\cdot \mathrm{Mg}_{3}\left(\mathrm{PO}_{4}\right)_{2}$

Name or Write a Formula for the following examples...

- NaOH
- $\mathrm{Ag}_{2} \mathrm{SO}_{3}$
- Beryllium Sulfate
- Tin(II) Iodide
- Aluminum Cyanide
- Zinc Hydroxide
- $\mathrm{Co}_{3} \mathrm{~N}_{2}$
- $\mathrm{Ga}\left(\mathrm{NO}_{2}\right)_{3}$
- $\mathrm{Mg}_{3} \mathrm{P}_{2}$
- Beryllium Acetate
- $\mathrm{Fe}_{3} \mathrm{~N}_{2}$
- Silver Sulfide


## Naming Acids

- Acids contain 1 or more H atoms
- H is the first element listed!


## Example HCl

- If anion ends with -ide (halogens).
- Acid name begins with hydro-


## hydrochloric acid

- Stem of anion ends with -ic
- End the name by writing acid
- For polyatomics...
- -ite endings become -ous, followed by acid

Example $\mathrm{H}_{2} \mathrm{SO}_{4}$

- -ate endings become -ic, followed by acid


## $\mathrm{SO}_{4}{ }^{2-}$ - Sulfate

## Naming Acids Practice

- HCl
- Cl- would be chloride, so it's hydrochloric acid.
- $\mathrm{H}_{2} \mathrm{SO}_{4}$
- $\mathrm{SO}_{4}{ }^{2-}$ would be sulfate, so it's sulfuric acid.
- $\mathrm{HClO}_{2}$
- $\mathrm{ClO}_{2}{ }^{-}$would be chlorite, so it's chlorous acid.


## Writing Acid Formulas

- Hydrogen forms a $1+$ charge in acids. Example - first element listed! Nitric acid
- Identify the anion (halogen or polyatomic) - Write the formula with charge
- Drop \& Cross
$\mathrm{H}^{+} \mathrm{NO}_{3}{ }^{-}$
-ic means an-ate polyatomic
$\mathrm{HNO}_{3}$


## Writing Acid Formulas

- Bromic Acid
- $\mathrm{HBrO}_{3}$
- Hydroiodic Acid
- HI
- Carbonous Acid
- $\mathrm{H}_{2} \mathrm{CO}_{2}$
- Nitrous Acid
- $\mathrm{HNO}_{2}$


## Overall Acid Practice

- $\mathrm{H}_{2} \mathrm{CO}_{3}$
- Hydroiodic acid
- $\mathrm{HC}_{2} \mathrm{H}_{3} \mathrm{O}_{2}$
- HBr
- Chloric acid
- $\mathrm{H}_{2} \mathrm{CO}_{3}$
- Hydrofluoric acid
- $\mathrm{H}_{3} \mathrm{PO}_{3}$


## Binary Molecular Compounds

- Review
- Binary = 2 elements
- What is an molecular compound?
- Composed of 2 nonmetals
- Composed of molecules, not ions...no charges!


## Binary Molecular Compounds

- Prefixes are used to indicate how many atoms of an element are present in the compound.

| Prefix | Meaning |
| :---: | :---: |
| Mono - | 1 |
| Di - | 2 |
| Tri - | 3 |
| Tetra - | 4 |
| Penta - | 5 |
| Hexa - | 6 |
| Hepta - | 7 |
| Octa - | 8 |
| Nona - | 9 |
| Deca - | 10 |

## Naming Binary Molecular Compounds

- Confirm that the two elements are nonmetals


## Example CO

- Name the $1^{\text {st }}$ element
- If only 1 of the $1^{\text {st }}$ element omit prefix

C - carbon

- If more than 1 of the $1^{\text {st }}$ element use prefix
- Name the $2^{\text {nd }}$ element (the more EN element)
- Always use a prefix
- Add -ide ending

O-monoxide
carbon monoxide

## Molecular Naming Practice

## Compound Formula

Compound Name
$\mathrm{N}_{2} \mathrm{O}_{4}$ $\mathrm{SO}_{3}$
NO
$\mathrm{NO}_{2}$
$\mathrm{As}_{2} \mathrm{O}_{5}$
$\mathbf{P C l}_{3}$
$\mathrm{CCl}_{4}$
$\mathrm{SeF}_{6}$

## Molecular Formula Practice

## Compound Formula

Compound Name
Dinitrogen Triiodide Diphosphorus pentoxide
Dinitrogen monoxide Silicon dioxide
Carbon tetrabromide
Sulfur dioxide
Phosphorus pentabromide
Iodine trichloride

## Overall Molecular Compounds Practice

- $\mathrm{PCl}_{3}$
- Diphosphorus trioxide
- $\mathrm{SF}_{6}$
- Carbon dioxide
- $\mathrm{C}_{2} \mathrm{H}_{6}$
- $\mathrm{CCl}_{4}$
- Dichlorine octoxide
- $\mathrm{N}_{2} \mathrm{O}$

