# Chapter 2: Atoms, molecules and ions 

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## Atomic number and Mass number



Atomic number 27

Mass number 59

Number of P 27
Number of e 27

Number of $n(59-27)=32$

Atomic number can also be found in the periodic table

Atomic Number


Mass number can also be found in the name of isotope


How many proton, neutron and electron are there in

|  | \#proton | \#neutron | \#electron | Type of <br> species |
| :---: | :---: | :---: | :---: | :---: |
| 56 <br> 26 Fe | 26 | $56-26=30$ | 26 | atom |
| 56 <br> 26 $\mathrm{Fe}^{+3}$ | 26 | $56-26=30$ | $26-3=23$ | cation |
| 32 <br> 16 <br> $S$ | 16 | $32-16=16$ | 16 | atom |
| $\frac{32}{16} \mathrm{~S}^{-2}$ | 16 | $32-16=16$ | $16+2=18$ | anion |

What is the name of an isotope with 19
protons and 17 neutrons?

## Element? Potassium <br> Mass Number? $\quad 19+17=36$ <br> Potassium-36

An atom of the isotope sodium- 24 consists of how many protons, neutrons, and electrons? $(\mathrm{p}=$ proton, $\mathrm{n}=$ neutron, $\mathrm{e}=$ electron $)$

Number of protons = atomic No. (Z)= 11
Number of electrons $=$ Number of protons $=11$
Number of neutrons = mass No. (A)- atomic No. (Z) $=24-11=13$

## Periodic Table

Main-group elements Representative elements (1A-8A)


What is the symbol of the element in Group 4A(14) and Period 2?
C
Si
Ge
Sn

```
Which element is in group 3 and period 2?
B
Al
Ca
Y
```

Which element consider as moderate conductor for

| $\begin{gathered} 1 \\ 1 \mathrm{~A} \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & 18 \\ & 8 \mathrm{~A} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 1 \\ & \mathbf{H} \end{aligned}$ | $\stackrel{2}{2 \mathrm{~A}}$ |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & 13 \\ & 3 \mathrm{~A} \end{aligned}$ | 14 4 A | $\begin{aligned} & 15 \\ & 5 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 16 \\ & 6 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 17 \\ & 7 \mathrm{~A} \end{aligned}$ | $\stackrel{2}{\mathrm{He}}$ |
| $\stackrel{3}{\mathbf{L i}}$ | $\stackrel{4}{\text { Be }}$ |  |  |  |  |  |  |  |  |  |  | [ ${ }^{5}$ | ${ }^{6}$ | $\stackrel{7}{\mathrm{~N}}$ | 8 0 | 9 | 10 Ne |
| $\begin{aligned} & 11 \\ & \mathrm{Na} \end{aligned}$ | $\begin{gathered} 12 \\ \mathbf{M g} \end{gathered}$ | $\begin{gathered} 3 \\ 3 \mathrm{~B} \\ \hline \end{gathered}$ | $\begin{array}{r} 4 \\ 4 \mathrm{~B} \\ \hline \end{array}$ | $\begin{gathered} 5 \\ 5 \mathrm{~B} \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ 6 \mathrm{~B} \end{gathered}$ | $\begin{gathered} 7 \\ 7 \mathrm{~B} \end{gathered}$ | 8 | $\stackrel{9}{8 B}$ | $10$ | $\begin{aligned} & 11 \\ & 1 \mathrm{~B} \\ & \hline \end{aligned}$ | $\begin{array}{r} 12 \\ 2 \mathrm{~B} \\ \hline \end{array}$ | $\begin{aligned} & 13 \\ & \text { A1 } \end{aligned}$ | 14 $\mathbf{S i}$ | $\begin{aligned} & 15 \\ & \mathbf{P} \end{aligned}$ | $\stackrel{16}{\text { S }}$ | $\begin{aligned} & 17 \\ & \mathrm{Cl} \end{aligned}$ | $\begin{aligned} & 18 \\ & \mathrm{Ar} \end{aligned}$ |
| $\begin{aligned} & 19 \\ & \mathbf{K} \end{aligned}$ | $\begin{aligned} & 20 \\ & \mathrm{Ca} \end{aligned}$ | $\begin{aligned} & 21 \\ & \mathbf{S c} \end{aligned}$ | $\begin{aligned} & 22 \\ & \mathbf{T i} \end{aligned}$ | $\begin{aligned} & 23 \\ & \mathbf{v} \end{aligned}$ | $\begin{aligned} & 24 \\ & \mathrm{Cr} \end{aligned}$ | $\begin{aligned} & 25 \\ & \mathbf{M n} \end{aligned}$ | $\begin{aligned} & 26 \\ & \mathbf{F e} \end{aligned}$ | $\begin{aligned} & 27 \\ & \mathrm{Co} \end{aligned}$ | $\begin{aligned} & 28 \\ & \mathbf{N i} \end{aligned}$ | $\begin{aligned} & 29 \\ & \mathrm{Cu} \end{aligned}$ | $\begin{aligned} & 30 \\ & \text { Zn } \end{aligned}$ | $\begin{aligned} & 31 \\ & \mathbf{G a} \end{aligned}$ | $\begin{aligned} & 32 \\ & \mathbf{G e} \end{aligned}$ | $\begin{aligned} & 33 \\ & \text { As } \end{aligned}$ | $\begin{aligned} & 34 \\ & \mathrm{Se} \end{aligned}$ | $\begin{aligned} & 35 \\ & \mathrm{Br} \end{aligned}$ | $\begin{aligned} & 36 \\ & \mathbf{K r} \end{aligned}$ |
| $\begin{aligned} & 37 \\ & \mathbf{R b} \end{aligned}$ | $\begin{aligned} & 38 \\ & \mathbf{S r} \end{aligned}$ | $\begin{aligned} & 39 \\ & \mathbf{Y} \end{aligned}$ | $\begin{aligned} & 40 \\ & \mathrm{Zr} \end{aligned}$ | $\begin{aligned} & 41 \\ & \mathbf{N b} \end{aligned}$ | $\begin{aligned} & 42 \\ & \text { Mo } \end{aligned}$ | $\begin{aligned} & 43 \\ & \mathbf{T c} \end{aligned}$ | $\begin{aligned} & 44 \\ & \mathrm{Ru} \end{aligned}$ | $\begin{aligned} & 45 \\ & \mathbf{R h} \end{aligned}$ | $\begin{aligned} & 46 \\ & \mathbf{P d} \end{aligned}$ | $\begin{aligned} & 47 \\ & \mathrm{Ag} \end{aligned}$ | $\begin{aligned} & 48 \\ & \mathrm{Cd} \end{aligned}$ | $\begin{aligned} & 49 \\ & \text { In } \end{aligned}$ | $\begin{aligned} & 50 \\ & \text { Sn } \end{aligned}$ | $\begin{aligned} & 51 \\ & \mathbf{S b} \end{aligned}$ | $\begin{aligned} & 52 \\ & \mathbf{T e} \end{aligned}$ | $\begin{gathered} 53 \\ \mathbf{I} \end{gathered}$ | $\begin{aligned} & 54 \\ & \mathbf{X e} \end{aligned}$ |
| $\begin{aligned} & 55 \\ & \mathrm{Cs} \end{aligned}$ | $\begin{aligned} & 56 \\ & \mathrm{Ba} \end{aligned}$ | $\begin{aligned} & 57 \\ & \mathbf{L a} \end{aligned}$ | 72 <br> $\mathbf{H f}$ | 73 $\mathbf{T a}$ | 74 $\mathbf{w}$ | $\begin{aligned} & 75 \\ & \mathbf{R e} \end{aligned}$ | 76 Os | 77 Ir | $\begin{aligned} & 78 \\ & \mathbf{P t} \end{aligned}$ | 79 Au | 80 $\mathbf{H g}$ | $\begin{aligned} & 81 \\ & \mathbf{T I} \end{aligned}$ | 82 <br> $\mathbf{P b}$ | $\begin{aligned} & 83 \\ & \text { Bi } \end{aligned}$ | 84 Po | $\begin{aligned} & 85 \\ & \text { At } \end{aligned}$ | $\begin{aligned} & 86 \\ & \mathbf{R n} \end{aligned}$ |
| $\begin{aligned} & 87 \\ & \mathbf{F r} \end{aligned}$ | $\begin{aligned} & 88 \\ & \text { Ra } \end{aligned}$ | 89 Ac | 104 Rf | 105 Db | $\begin{aligned} & 106 \\ & \mathrm{Sg} \end{aligned}$ | $\begin{aligned} & 107 \\ & \text { Bh } \end{aligned}$ | 108 Hs | 109 $\mathbf{M t}$ | $\begin{aligned} & 110 \\ & \text { Ds } \end{aligned}$ | 111 $\mathbf{R g}$ | 112 | (113) | 114 | (115) | 116 | (117) | (118) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Metals |  |  | $\begin{aligned} & 58 \\ & \mathrm{Ce} \end{aligned}$ | $\begin{aligned} & 59 \\ & \mathrm{Pr} \end{aligned}$ | $\begin{aligned} & 60 \\ & \mathrm{Nd} \end{aligned}$ | $\begin{gathered} 61 \\ \mathrm{Pm} \end{gathered}$ | $\begin{aligned} & 62 \\ & \mathrm{Sm} \end{aligned}$ | $\begin{aligned} & 63 \\ & \text { Eu } \end{aligned}$ | $\begin{aligned} & 64 \\ & \mathbf{G d} \end{aligned}$ | $\begin{aligned} & 65 \\ & \mathbf{T b} \end{aligned}$ | $\begin{aligned} & 66 \\ & \text { Dy } \end{aligned}$ | $\begin{aligned} & 67 \\ & \mathbf{H o} \end{aligned}$ | $\begin{aligned} & 68 \\ & \mathbf{E r} \end{aligned}$ | $\begin{aligned} & 69 \\ & \mathbf{T m} \end{aligned}$ | $\begin{aligned} & 70 \\ & \mathbf{Y b} \end{aligned}$ | $\begin{aligned} & 71 \\ & \mathrm{Lu} \end{aligned}$ |
|  | Metalloids |  |  | $\begin{aligned} & 90 \\ & \text { Th } \end{aligned}$ | $\begin{aligned} & 91 \\ & \mathrm{~Pa} \end{aligned}$ | $\begin{aligned} & 92 \\ & \mathbf{U} \end{aligned}$ | $\begin{aligned} & 93 \\ & \mathrm{~Np} \end{aligned}$ | $\begin{aligned} & 94 \\ & \mathrm{Pu} \end{aligned}$ | $\begin{gathered} 95 \\ \text { Am } \end{gathered}$ | $\begin{aligned} & 96 \\ & \mathbf{C m} \end{aligned}$ | $\begin{aligned} & 97 \\ & \text { Bk } \end{aligned}$ | $\begin{aligned} & 98 \\ & \text { Cf } \end{aligned}$ | 99 Es | $\begin{aligned} & 100 \\ & \mathbf{F m} \end{aligned}$ | $\begin{aligned} & 101 \\ & \text { Md } \end{aligned}$ | $\begin{aligned} & 102 \\ & \mathrm{No} \end{aligned}$ | $\begin{aligned} & 103 \\ & \mathbf{L r} \end{aligned}$ | electricity and heat?

Ti

Si
P
Be

## Chemical formulas

## Empirical or molecular?

$$
\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{2} \text { (molecular) } \mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{2} \xrightarrow{/ 2} \mathrm{C}_{3} \mathrm{H}_{6} \mathrm{O}
$$

$$
\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O} \quad \text { (empirical) }
$$

$$
\mathrm{C}_{5} \mathrm{H}_{11} \mathrm{O} \quad \text { (empirical) }
$$

$$
\mathrm{H}_{2} \mathrm{~S} \quad \text { (empirical) }
$$

## Writing compound formula

Firstly, Decide if the compound Ionic or Molecular compound
How !! look to the first element,
if it is metal or $\mathrm{NH}_{4} \rightarrow$ ionic if it is metallod or nonmetal $\rightarrow$ molecular

## In case of ionic compound:

- write the ion symbol of each part with its oxidation number
- put the oxidation number of each part as subscript for the other part ( قاعدة تبادل النكافؤات )
- simplify the formula if you can

In case of molecular compound:

- write the elements symbol as they appear in the compound name
- the subscript will be the prefixes of each element
- don't simplify the formula

Write the chemical formula:
dichlorine octoxide $\longrightarrow$ (molecular) $\mathrm{Cl}_{2} \mathrm{O}_{8}$
DON'T simplify C1 ${ }_{4}$

## Ionic formulas

What is the formula for the ionic compound formed by magnesium and Chloride?


## Ionic formulas

What is the formula for the ionic compound formed by magnesium and selenium?


## Ionic formulas

What is the formula for the ionic compound formed by Tin(IV) and Oxygen?


## Ionic formulas

What is the formula for the ionic compound formed by calcium and phosphate?

| calcium | phosphate |
| :---: | :---: |
| $\mathrm{Ca}^{+2}$ | $\left(\mathrm{PO}_{4}\right)^{-3}$ |
| $\mathrm{Ca}_{3}\left(\mathrm{PO}_{4}\right)_{2}$ |  |
| يجب التكاكد عند تكوين المركب الأيوني أن صيتته مبسطة The formula is always in the simplest form |  |

What is the valency (oxidation number) of oxygen in $\mathrm{Cr}_{2} \mathrm{O}_{3}$

oxidation number for oxygen $=-2$ oxidation number for chromium $=+3$

What is the valency (oxidation number) of element in $\mathrm{CaCl}_{2}$

$$
\begin{gathered}
\mathrm{Ca}_{1} \mathrm{Cl}_{2} \\
+2 \text { atom } \left\lvert\, \begin{array}{l}
-1 \\
+2+-2=0
\end{array}\right. \\
+2 \text { atoms } \\
+2
\end{gathered}
$$

oxidation number for calcium $=+2$ oxidation number for chloride $=+1$

## Naming compound

Firstly, Decide if the compound Ionic or Molecular compound
How !! look to the first element,
if it is metal or $\mathrm{NH}_{4} \rightarrow$ ionic
if it is metallod or nonmetal $\rightarrow$ molecular

| $\begin{gathered} 1 \\ 1 \mathrm{~A} \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & 18 \\ & 8 \mathrm{~A} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 1 \\ & \mathbf{H} \end{aligned}$ | $\stackrel{2}{2 \mathrm{~A}}$ |  |  |  |  |  |  |  |  |  |  | $\begin{array}{r} 13 \\ 3 \mathrm{~A} \end{array}$ | $\begin{aligned} & 14 \\ & 4 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 15 \\ & 5 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 16 \\ & 6 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 17 \\ & 7 \mathrm{~A} \end{aligned}$ | $\stackrel{2}{\mathrm{He}}$ |
| $\stackrel{3}{\mathbf{L i}}$ | $\begin{gathered} 4 \\ \mathrm{Be} \end{gathered}$ |  |  |  |  |  |  |  |  |  |  | B | ${ }_{6}^{6}$ | $\stackrel{7}{\mathrm{~N}}$ | 8 | 9 | 10 Ne |
| $\begin{aligned} & 11 \\ & \mathrm{Na} \end{aligned}$ | $\begin{gathered} 12 \\ \mathbf{M g} \end{gathered}$ | $\begin{gathered} 3 \\ 3 \mathrm{~B} \end{gathered}$ | $\begin{gathered} 4 \\ 4 B \end{gathered}$ | $\begin{gathered} 5 \\ 5 B \end{gathered}$ | $\begin{gathered} 6 \\ 6 \mathrm{~B} \end{gathered}$ | $\begin{gathered} 7 \\ 7 \mathrm{~B} \end{gathered}$ |  |  | 10 | $\begin{aligned} & 11 \\ & 1 \mathrm{~B} \end{aligned}$ | $\begin{aligned} & 12 \\ & 2 B \end{aligned}$ | $\begin{aligned} & 13 \\ & \text { A1 } \end{aligned}$ | $\begin{aligned} & 14 \\ & \mathrm{Si} \end{aligned}$ | $\begin{aligned} & 15 \\ & \mathbf{P} \end{aligned}$ | $\stackrel{16}{\mathrm{~S}}$ | $\begin{aligned} & 17 \\ & \mathrm{Cl} \end{aligned}$ | $\begin{aligned} & 18 \\ & \mathbf{A r} \end{aligned}$ |
| $\begin{aligned} & 19 \\ & \mathbf{K} \end{aligned}$ | $\begin{aligned} & 20 \\ & \mathrm{Ca} \end{aligned}$ | $\begin{aligned} & 21 \\ & \mathrm{Sc} \end{aligned}$ | $\begin{aligned} & 22 \\ & \mathbf{T i} \end{aligned}$ | $\begin{gathered} 23 \\ \mathbf{v} \end{gathered}$ | $\begin{aligned} & 24 \\ & \mathrm{Cr} \end{aligned}$ | $\begin{gathered} 25 \\ \mathbf{M n} \end{gathered}$ | $\begin{aligned} & 26 \\ & \mathrm{Fe} \end{aligned}$ | $\begin{aligned} & 27 \\ & \mathrm{Co} \end{aligned}$ | $\begin{aligned} & 28 \\ & \mathbf{N i} \end{aligned}$ | $\begin{aligned} & 29 \\ & \mathrm{Cu} \end{aligned}$ | $\begin{aligned} & 30 \\ & \mathbf{Z n} \end{aligned}$ | $\begin{aligned} & 31 \\ & \mathbf{G a} \end{aligned}$ | $\begin{aligned} & 32 \\ & \mathbf{G e} \end{aligned}$ | $\begin{gathered} 33 \\ \text { As } \end{gathered}$ | $\begin{aligned} & 34 \\ & \mathrm{Se} \end{aligned}$ | $\begin{aligned} & 35 \\ & \mathrm{Br} \end{aligned}$ | $\begin{aligned} & 36 \\ & \mathbf{K r} \end{aligned}$ |
| $\begin{aligned} & 37 \\ & \mathbf{R b} \end{aligned}$ | $\begin{aligned} & 38 \\ & \mathbf{S r} \end{aligned}$ | $\begin{aligned} & 39 \\ & \mathbf{Y} \end{aligned}$ | $\begin{aligned} & 40 \\ & \mathrm{Zr} \end{aligned}$ | $\begin{aligned} & 41 \\ & \mathbf{N b} \end{aligned}$ | $\begin{aligned} & 42 \\ & \text { Mo } \end{aligned}$ | $\begin{aligned} & 43 \\ & \mathrm{Tc} \end{aligned}$ | $\begin{aligned} & 44 \\ & \mathbf{R u} \end{aligned}$ | $\begin{aligned} & 45 \\ & \mathbf{R h} \end{aligned}$ | $\begin{aligned} & 46 \\ & \mathbf{P d} \end{aligned}$ | $\begin{aligned} & 47 \\ & \mathrm{Ag} \end{aligned}$ | $\begin{aligned} & 48 \\ & \mathrm{Cd} \end{aligned}$ | $\begin{aligned} & 49 \\ & \text { In } \end{aligned}$ | $\begin{aligned} & 50 \\ & \text { Sn } \end{aligned}$ | $\begin{aligned} & 51 \\ & \mathbf{S b} \end{aligned}$ | $\begin{aligned} & 52 \\ & \mathrm{Te} \end{aligned}$ | $\begin{gathered} 53 \\ \text { I } \end{gathered}$ | $\begin{aligned} & 54 \\ & \mathbf{X e} \end{aligned}$ |
| $\begin{aligned} & 55 \\ & \mathrm{Cs} \end{aligned}$ | $\begin{aligned} & 56 \\ & \text { Ba } \end{aligned}$ | $\begin{aligned} & 57 \\ & \mathbf{L a} \end{aligned}$ | $\begin{aligned} & 72 \\ & \mathbf{H f} \end{aligned}$ | $\begin{aligned} & 73 \\ & \mathrm{Ta} \end{aligned}$ | $\begin{aligned} & 74 \\ & \mathbf{w} \end{aligned}$ | $\begin{aligned} & 75 \\ & \mathbf{R e} \end{aligned}$ | $\begin{aligned} & 76 \\ & \text { Os } \end{aligned}$ | $\begin{aligned} & 77 \\ & \mathbf{I r} \end{aligned}$ | $\begin{aligned} & 78 \\ & \mathbf{P t} \end{aligned}$ | $\begin{aligned} & 79 \\ & \mathbf{A u} \end{aligned}$ | $\begin{gathered} 80 \\ \mathbf{H g} \end{gathered}$ | $\begin{aligned} & 81 \\ & \mathbf{T I} \end{aligned}$ | $\begin{aligned} & 82 \\ & \mathbf{P b} \end{aligned}$ | $\begin{aligned} & 83 \\ & \mathrm{Bi} \end{aligned}$ | $\begin{aligned} & 84 \\ & \text { Po } \end{aligned}$ | $\begin{aligned} & 85 \\ & \text { At } \end{aligned}$ | $\begin{aligned} & 86 \\ & \mathbf{R n} \end{aligned}$ |
| $\begin{aligned} & 87 \\ & \mathbf{F r} \end{aligned}$ | $\begin{aligned} & 88 \\ & \mathbf{R a} \end{aligned}$ | $\begin{aligned} & 89 \\ & \mathbf{A c} \end{aligned}$ | $\begin{aligned} & 104 \\ & \mathbf{R f} \end{aligned}$ | $\begin{aligned} & 105 \\ & \text { Db } \end{aligned}$ | $\begin{aligned} & 106 \\ & \text { Sg } \end{aligned}$ | $\begin{aligned} & 107 \\ & \mathbf{B h} \end{aligned}$ | $\begin{aligned} & 108 \\ & \text { Hs } \end{aligned}$ | $\begin{aligned} & 109 \\ & \mathbf{M t} \end{aligned}$ | $\begin{aligned} & 110 \\ & \text { Ds } \end{aligned}$ | $\begin{aligned} & 111 \\ & \mathbf{R g} \end{aligned}$ | 112 | (113) | 114 | (115) | 116 | (117) | (118) |


| Metals | $\begin{aligned} & 58 \\ & \mathrm{Ce} \end{aligned}$ | $\begin{aligned} & 59 \\ & \mathbf{P r} \end{aligned}$ | $\begin{gathered} 60 \\ \mathrm{Nd} \end{gathered}$ | $\begin{aligned} & 61 \\ & \text { Pm } \end{aligned}$ | $\begin{gathered} 62 \\ \mathrm{Sm} \end{gathered}$ | $\begin{aligned} & 63 \\ & \text { Eu } \end{aligned}$ | $\begin{gathered} 64 \\ \mathbf{G d} \end{gathered}$ | $\begin{aligned} & 65 \\ & \mathbf{T b} \end{aligned}$ | $\begin{aligned} & 66 \\ & \text { Dy } \end{aligned}$ | $\begin{aligned} & 67 \\ & \mathbf{H o}_{0} \end{aligned}$ | $\begin{aligned} & 68 \\ & \mathbf{E r} \end{aligned}$ | $\begin{gathered} 69 \\ \mathbf{T m} \end{gathered}$ | $\begin{aligned} & 70 \\ & \mathbf{Y b} \end{aligned}$ | $\begin{aligned} & 71 \\ & \mathbf{L u} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Metalloids | $\begin{aligned} & 90 \\ & \text { Th } \end{aligned}$ | $\begin{aligned} & 91 \\ & \mathbf{P a} \end{aligned}$ | $\begin{aligned} & 92 \\ & \mathbf{U} \end{aligned}$ | $\begin{gathered} 93 \\ \mathbf{N p} \end{gathered}$ | $\begin{aligned} & 94 \\ & \mathbf{P u} \end{aligned}$ | $\begin{gathered} 95 \\ \text { Am } \end{gathered}$ | $\begin{aligned} & 96 \\ & \mathbf{C m} \end{aligned}$ | $\begin{aligned} & 97 \\ & \mathbf{B k} \end{aligned}$ | $\begin{aligned} & 98 \\ & \mathbf{C f} \end{aligned}$ | $\begin{aligned} & 99 \\ & \text { Es } \end{aligned}$ | $\begin{aligned} & 100 \\ & \text { Fm } \end{aligned}$ | $\begin{aligned} & 101 \\ & \text { Md } \end{aligned}$ | $\begin{aligned} & 102 \\ & \text { No } \end{aligned}$ | $\begin{aligned} & 103 \\ & \mathbf{L r} \end{aligned}$ |

Nonmetals

## Naming compound

## Firstly, Decide if the compound Ionic or Molecular compound

How !! look to the first element,
if it is metal or $\mathrm{NH}_{4} \rightarrow$ ionic
if it is metallod or nonmetal $\rightarrow$ molecular
Ionic Compounds
Metal cation + Nonmetal anion

Metal Cation: takes their names
Nonmetal Anion: Take the from the element

Metals form only one type of cation:
Just put the name

> Metals form more than one type
> of cation (10 metals) use stock
> system, i.e show the oxidation
> number of metal by adding roman
> number after the metal name
first part of the element name and add -ide

Note : for the common cation or anion, just put the name as it

| $\begin{gathered} 1 \\ 1 \mathrm{~A} \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & 18 \\ & 8 \mathrm{~A} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} 2 \\ 2 \mathrm{~A} \end{gathered}$ |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & 13 \\ & 3 \mathrm{~A} \end{aligned}$ | $14$ | $\begin{aligned} & 15 \\ & 5 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 16 \\ & 6 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 17 \\ & 7 \mathrm{~A} \end{aligned}$ |  |
| $\mathbf{L i}^{+}$ |  |  |  |  |  |  |  |  |  |  |  |  | $\mathrm{C}^{4-}$ | $\mathrm{N}^{3-}$ | $\mathrm{O}^{2-}$ | $\mathrm{F}^{-}$ |  |
| $\mathrm{Na}^{+}$ | Mg ${ }^{2+}$ | $\begin{gathered} 3 \\ 3 \mathrm{~B} \\ \hline \end{gathered}$ | $\begin{gathered} 4 \\ 4 B \end{gathered}$ | $\begin{gathered} 5 \\ 5 B \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ 6 \mathrm{~B} \end{gathered}$ | $\begin{gathered} 7 \\ 7 \mathrm{~B} \end{gathered}$ | $8$ | $\begin{gathered} 9 \\ -8 B \end{gathered}$ | $10$ | $\begin{aligned} & 11 \\ & 1 \mathrm{~B} \end{aligned}$ | $\begin{aligned} & 12 \\ & 2 \mathrm{~B} \end{aligned}$ | $\mathrm{Al}^{3+}$ |  | $\mathrm{P}^{3}$ | $\mathrm{S}^{2-}$ | $\mathrm{Cl}^{-}$ |  |
| $\mathbf{K}^{+}$ | $\mathrm{Ca}^{2+}$ |  |  |  | $\begin{aligned} & \mathrm{Cr}^{2+} \\ & \mathrm{Cr}^{3+} \end{aligned}$ | $\begin{aligned} & \mathrm{Mn}^{2+} \\ & \mathrm{Mn}^{3+} \end{aligned}$ | $\begin{aligned} & \mathrm{Fe}^{2+} \\ & \mathrm{Fe}^{3+} \end{aligned}$ | $\begin{aligned} & \mathrm{Co}^{2+} \\ & \mathrm{Co}^{3+} \end{aligned}$ | $\begin{aligned} & \mathrm{Ni}^{\mathbf{2 +}} \\ & \mathrm{Ni}^{3+} \end{aligned}$ | $\begin{gathered} \mathrm{Cu}^{+} \\ \mathrm{Cu}^{2+} \end{gathered}$ | $\mathbf{Z n}^{\mathbf{2 +}}$ |  |  |  | $\mathrm{Se}^{2-}$ | $\mathrm{Br}^{-}$ |  |
| $\mathbf{R b}^{+}$ | $\mathrm{Sr}^{2+}$ |  |  |  |  |  |  |  |  | $\mathbf{A g}^{+}$ | $\mathrm{Cd}^{2+}$ |  | $\begin{aligned} & \mathrm{Sn}^{2+} \\ & \mathrm{Sn}^{4+} \end{aligned}$ |  | $\mathrm{Te}^{2-}$ | $\mathrm{I}^{-}$ |  |
| Cs ${ }^{+}$ | $\mathrm{Ba}^{2+}$ |  |  |  |  |  |  |  |  | $\begin{gathered} \mathrm{Au}^{+} \\ \mathrm{Au}^{3+} \end{gathered}$ | $\begin{aligned} & \mathbf{H g}_{2}^{2+} \\ & \mathbf{H g}^{2+} \end{aligned}$ |  | $\begin{aligned} & \mathbf{P b}^{2+} \\ & \mathbf{P b}^{4+} \end{aligned}$ |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Molecular Compounds

Place the name of the first element in the formula first, and the second element is named by adding -ide at the last of the name.

Rules to name molecular compounds:
Rule 1: use Greek prefixes to denote the number of atoms of each element

Rule 2: Drop mono for the first element
Rule 3: Drop all prefixes if the first element is H
Rule 4: Drop the second o in mono prior to a vowel (monoxide)

Rule 5: Drop the a in prefixes ending in a prior to a vowel (tetroxide)

HCl
Hydrogen Chloride

| B | C | N | O |
| :---: | :---: | :--- | :--- |
| boron carbon | nitrogen | oxygen | fluorine |
| Si | P | S | Cl |
| silicon |  |  | phosphorus |
| sulfur | chlorine |  |  |
|  | As | Se | Br |
|  | arsenic | selenium bromine |  |
|  |  | Te | I |
|  |  | tellurium iodine |  |

TABLE 2.4

| Common names |
| :--- |
| $\mathrm{H}_{2} \mathrm{O}$ water |
| $\mathrm{NH}_{3}$ ammonia |
| $\mathrm{CH}_{4}$ methane |
| $\mathrm{H}_{2} \mathrm{~S}$ hydrogen sulfide |
| $\mathrm{SiH}_{4}$ silane |
| $\mathrm{B}_{2} \mathrm{H}_{6}$ diborane |


| Molecular <br> Formula | Number of Atoms <br> of First Element | Number of Atoms <br> of Second Element | Name of Compound |
| :--- | :---: | :---: | :--- |
| CIF | 1 | 1 | Chlorine monofluoride |
| $\mathrm{ClF}_{5}$ | 1 | 5 | Chlorine pentafluoride |
| $\mathbf{C O}$ | 1 | 1 | Carbon monoxide |
| $\mathbf{C O}_{2}$ | 1 | 2 | Carbon dioxide |
| $\mathrm{Cl}_{2} \mathbf{O}$ | 2 | 1 | Dichlorine monoxide |
| $\mathbf{P C l}_{5}$ | 1 | 5 | Phosphorus pentachlroride |
| $\mathbf{N O}_{2}$ | 2 | 5 | Dinitrogen pentoxide |


| Molecular Formula | Name of Compound |
| :--- | :--- |
| $\mathbf{B C l}_{\mathbf{3}}$ | Boron trichloride |
| $\mathbf{S F}_{6}$ | Sulfur hexafluoride |
| $\mathbf{N I}_{\mathbf{3}}$ | Nitrogen triiodide |
| $\mathbf{N 2 O 4}$ | Dinitrogen tetroxide |
| $\mathbf{C l} \mathbf{O}$ | Dichlorine monoxide |
| $\mathbf{B 5 H 9}$ | Pentaboron nonahydride |
| $\mathbf{B r 3 O 8}$ | Tribromine octoxide |
| $\mathbf{C l F}$ | Chlorine monofluoride |


| Chemical Formula | Type of Compound | Compound Name |
| :--- | :--- | :--- |
| $\mathbf{M g F}_{\mathbf{2}}$ | Ionic | Magnesium fluoride |
| $\mathbf{C u F}_{\mathbf{2}}$ | Molecular (covalent) | Sulfur difluoride |
| $\mathbf{S F} \mathbf{2}$ | Ionic | Sodium bromide |
| $\mathbf{N a B r}$ | Ionic | Gold(I) bromide |
| $\mathbf{A u B r}$ | Molecular (covalent) | Iodine monobromide |
| $\mathbf{I B r}$ |  |  |


| Chemical Formula | Type of Compound | Compound Name |
| :--- | :--- | :--- |
| $\mathbf{M g F}_{\mathbf{2}}$ | Ionic | Magnesium fluoride |
| $\mathbf{C u F}_{\mathbf{2}}$ | Molecular (covalent) | Sulfur difluoride |
| $\mathbf{S F} \mathbf{2}$ | Ionic | Sodium bromide |
| $\mathbf{N a B r}$ | Ionic | Gold(I) bromide |
| $\mathbf{A u B r}$ | Molecular (covalent) | Iodine monobromide |
| $\mathbf{I B r}$ |  |  |

Name the following compound $\mathrm{Pb}\left(\mathrm{SO}_{4}\right)_{2}$
lead (IV) sulfate
lead (II) sulfate
lead (IV) sulfide
lead sulfate

Name the following compound $\mathrm{NH}_{4} \mathrm{Cl}$
ammonium chloride
ammonium monochloride
ammonium chlorine
amine chloride

Name the following compound $\mathrm{Al}(\mathrm{CN})_{3}$
aluminum cyanide
aluminum (III) cyanide
aluminum (III) cyano
aluminum carbide

## Thank you

