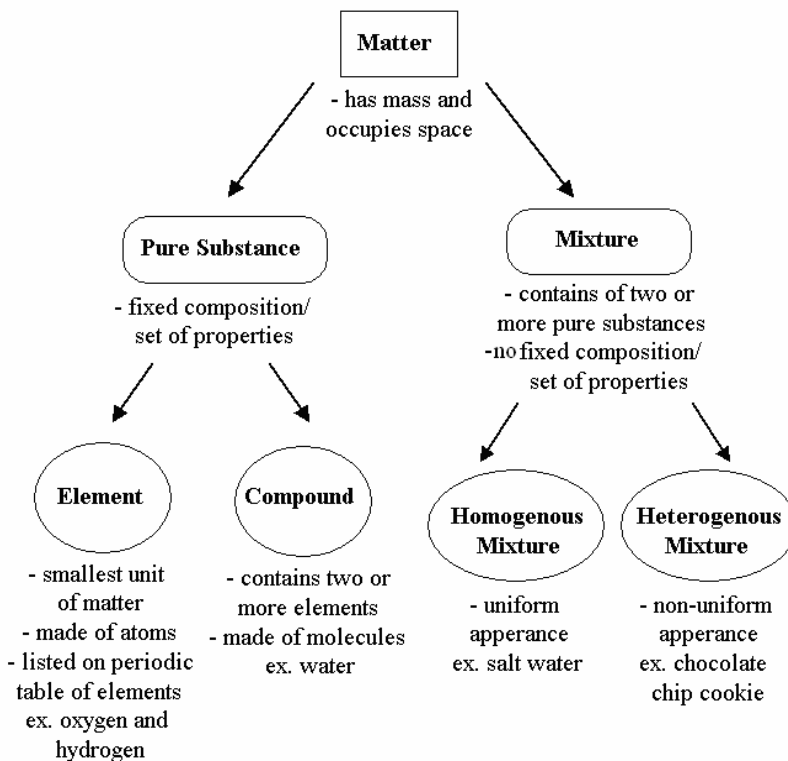


## Classification of Matter



## Classification of Elements

Elements on the periodic table can be classified as metal, non-metals, or metalloids

<b>Metals</b>	<b>Non-Metals</b>
<ul style="list-style-type: none"> <li>- elements to the left of the “staircase”</li> <li>- malleable (can be flattened into sheets)</li> <li>- ductile (can be pulled into wires)</li> <li>- shiny</li> <li>- good conductors of heat and electricity</li> </ul> <p>examples:</p>	<ul style="list-style-type: none"> <li>- elements to the right of the “staircase”)</li> <li>- brittle</li> <li>- dull</li> <li>- poor conductors of heat and electricity (insulators)</li> </ul> <p>examples:</p>

### **Metalloids**

- found along the “staircase” (B, Si, Ge, As, Sb, Te, Po)
- have some properties of metals and some properties of non-metals
- metalloids are semi-conductors

## Compounds

### Ionic Compounds

- Form between a metal and a non-metal
- Electrons are transferred from the metal to the non-metal to form ions that have a full valence shell
- The metal becomes a positively charged cation and the non-metal becomes a negatively charged anion
- Ions are held together by electrostatic attraction of opposite charges

### Lewis Diagrams

Draw the electron dot structure for each element. Determine the number of atoms of each element needed to form an ionic bond. Draw the Lewis diagrams for each atom before the bond forms and after the bond forms. Write the formula for the compound that forms and name the compound.

ex. sodium and chlorine

ex. calcium and oxygen

ex. lithium and nitrogen

### Simple Ionic Compounds

#### I. Naming simple ionic compounds

- (1) Name the metal
- (2) Name the non-metal and change the ending to "ide"

ex. KI

ex. BaO

ex. MgF<sub>2</sub>

ex. ScCl<sub>3</sub>

ex. Ga<sub>2</sub>O<sub>3</sub>

#### II. Writing formulas for simple ionic compounds

- (1) Write the symbol and charge for the metal
- (2) Write the symbol and charge for the non-metal
- (3) Use the charges to determine the number of atoms of each element required
- (4) Write the formula indicating the number of atoms of each element with subscripts

ex. lithium bromide

ex. strontium sulphide

ex. sodium oxide

ex. aluminum chloride

ex. calcium nitride

## Multivalent metals

**Multivalent metal:** a metal with more than one possible charge listed on the periodic table. (ex. Fe, Cu, Pb)

### I. Naming multivalent metals

(1) Name the metal indicating the charge with a roman numeral. (Use the number of atoms of each ion to determine the charge)

Charge	Roman Numeral
+1	I
+2	II
+3	III
+4	IV
+5	V
+6	VI
+7	VII

(2) Name the non-metal

ex. CuCl

ex. CuCl<sub>2</sub>

ex. FeO

ex. Fe<sub>2</sub>O<sub>3</sub>

ex. PbS

ex. PbS<sub>2</sub>

### II. Writing formulas for multivalent metals

(1) Write the symbol and charge for the metal (use the Roman Numeral given in the name to determine the charge)

(2) Write the symbol and charge for the non-metal

(3) Use the charges to determine the number of atoms of each element required

(4) Write the formula indicating the number of atoms of each element with subscripts

ex. gold (I) bromide

ex. gold (III) bromide

ex. nickel (II) oxide

ex. nickel (III) oxide

ex. chromium (II) phosphide

ex. chromium (III) phosphide

## Polyatomic Ions

**Polyatomic Ions:** groups of elements that combine together to form a single ion.

ex. sulphate: SO<sub>4</sub><sup>2-</sup> : 1 S, 4 O charge -2

ex. acetate:

### I. Naming polyatomic ions

(1) Name the metal first (if the metal is multivalent, a Roman Numeral must be included to indicate the charge)

(2) Name the polyatomic ion (note: the ending of the polyatomic does not change)

ex. CaSO<sub>4</sub>

ex. NaNO<sub>3</sub>

ex. Mg(OH)<sub>2</sub>

ex. NH<sub>4</sub>Cl

ex. CrCO<sub>2</sub>

## II. Writing formulas for polyatomic ions

- (1) Write the symbol and charge for the metal
- (2) Write the symbol and charge for the polyatomic ion
- (3) Use the charges to determine the number of each ion required
- (4) Write the formula indicating the number of atoms of each element with subscripts (if more than one of a polyatomic ion is required, the formula must be written using parentheses)

ex. potassium carbonate

ex. barium chlorate

ex. ammonium sulphate

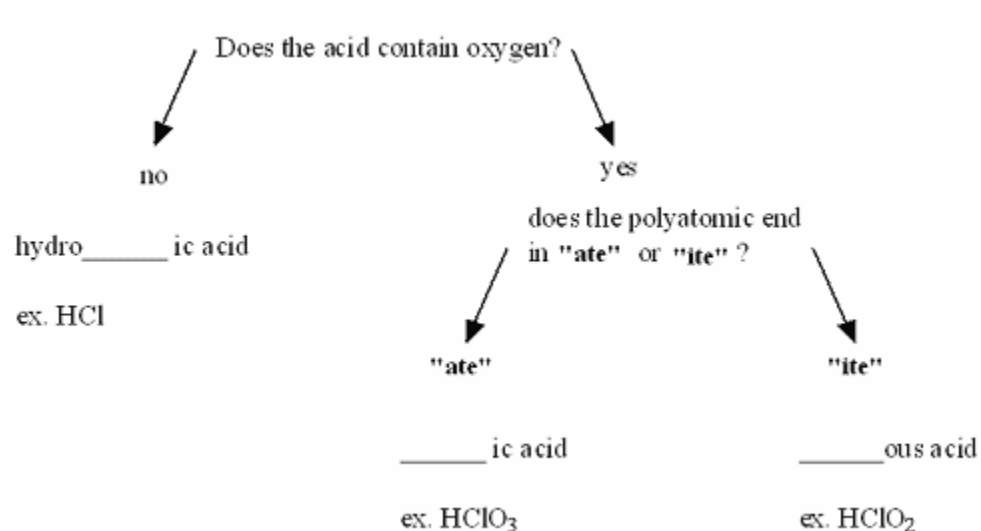
ex. iron (III) phosphate

ex. manganese (IV) acetate

## Acids

Begin with a hydrogen

### I. Naming acids



### II. Writing formulas for acids

- (1) Write the symbol and charge for hydrogen (H<sup>+</sup>)
- (2) Use the prefix/ending of the name to determine the second part of the compound
- (3) Use the charges to determine the number of each ion required
- (4) Write the formula indicating the number of atoms of each element with subscripts

ex. hydrosulphuric acid

ex. sulphuric acid

ex. sulphurous acid

## Covalent Compounds

- Form between a non-metal and a non-metal
- Electrons are shared between atoms so that all atoms have a full valence shell

Draw the electron dot structure for each element. Determine the number of atoms of each element needed to form a covalent bond. Draw the Lewis diagrams for each atom before the bond forms and after the bond forms. Write the formula for the compound that forms and name the compound.

ex. chlorine

ex. silicon and fluorine

ex. carbon and sulphur

### I. Naming covalent compounds

- (1) Name the first element and use a prefix to indicate the number of atoms (if there is only one atom, it is not necessary to say "mono")
- (2) Name second element and use a prefix to indicate the number of atoms. Change the ending to "ide".

Number of Atoms	Prefix
1	mono
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	non
10	deca

ex.  $\text{CF}_4$

ex.  $\text{NI}_3$

ex.  $\text{P}_2\text{O}_5$

ex.  $\text{SF}_6$

### Dropping vowels between a prefix and the first letter of an element

- the vowel at the end of a prefix ending in "a" or "o" is dropped for compounds where the second element begins with an "a" or "o" (ex. monoxide is written monoxide or pentoxide is written pentoxide)
- the vowel is not dropped if the prefix ends in an "i" or the second element begins with an "i" (ex. dioxide, triiodide, tetraiodide)

## II. Writing formulas for covalent compounds

(1) Write the symbol for the first element

(2) Write the symbol for the second element

(3) Use the prefixes to determine the number of atoms of each element and write the formula indicating the number of atoms of each element with subscripts

ex. carbon monoxide

ex. sulphur trioxide

ex. tetraphosphorus decoxide

## Diatomic Elements

**diatomic elements:** these elements are always found with two atoms

Element	Formula
hydrogen	H <sub>2</sub>
oxygen	O <sub>2</sub>
fluorine	F <sub>2</sub>
bromine	Br <sub>2</sub>
iodine	I <sub>2</sub>
nitrogen	N <sub>2</sub>
chlorine	Cl <sub>2</sub>

Just remember HOFBrINCl