

## 9 TYPES OF COMPOUNDS & NOMENCLATURE

1. Warm-up. Here are several examples of compounds. How can we categorize them, in your opinion?



2. How to Identify Different Types of Chemical Compounds <https://www.youtube.com/watch?v=Nm-2Hlrca2s>

Give an example for each type. Then watch the video and add adjectives that are used to describe the types. 0-3.50

Type	example	description
Compound with a trivial name:	<i>Oil of vitriol, lime, water glass</i>	<i>old name used instead of a systematic one</i>
Compound of a metal and a non-metal:	<i>NaCl</i>	<i>Binary, ionic</i>
Compound of a metal and a polyatomic ion:		
Compounds with transition metals:		
Compound of two non-metals:		

3. Commercially important compounds.

Look at the middle part with names. Can you complete some of them in English?

### Ionic compounds

Formula	Name	Use: choose a word for each gap from the list below
NH <sub>4</sub> NO <sub>3</sub>	ammonium nitrate	_____ <sup>1</sup> and explosives
KNO <sub>3</sub>	.....	gunpowder and matches
Na <sub>2</sub> CO <sub>3</sub>	.....	water softening, _____ <sup>2</sup> , paper industry
NaHCO <sub>3</sub>	sodium bicarbonate	household, food industry
NaOH	.....	_____ <sup>3</sup> , detergents
CaSO <sub>4</sub>	.....	gypsum, wallboard

### Molecular compounds

Formula	Name	Use: choose a word for each gap from the list below
CO	carbon monoxide	preparation of methanol and other organic chemicals
CO <sub>2</sub>	.....	carbonated beverages, fire _____ <sup>4</sup> , dry ice
N <sub>2</sub> O	laughing gas	spray-can _____ <sup>5</sup> , anesthetic
SO <sub>2</sub>	.....	for sulfuric acid, food _____ <sup>6</sup> , metal refining
SO <sub>3</sub>	.....	preparation of sulfuric acid
CCl <sub>4</sub>	.....	_____ <sup>7</sup>
SF <sub>6</sub>	.....	_____ <sup>8</sup> in electric transformers
P <sub>4</sub> O <sub>10</sub>	.....	preparation of phosphoric acid

Joesten, Castellion, Hogg: The World of Chemistry, Thomson Brooks/Cole, 2007, p.99  
J. Shipman, J. Wilson, A. Todd, An Introduction to Physical Science, Houghton Mifflin Company, 2006, p.299

Now add the vocabulary for the uses of these commercially important compounds:

*solvents          soaps          detergents          fertilizers          insulators*  
*propellants          preservative          extinguishers*

#### 4. INORGANIC NOMENCLATURE

Source: Shipman, Wilson, Todd: An Introduction to Physical Science, p.297

##### A) Naming a compound of a metal and a nonmetal

For now, we deal with naming compounds of metals that form only one ion, which are mainly those of Groups 1A and 2A. To name a binary compound of a metal combined with a non-metal, first give the name of the metal and then give the name of the non-metal with its ending changed to *-ide*.

$\text{Al}_2\text{O}_3$  aluminium oxide  
 $\text{Ca}_3\text{N}_2$  calcium nitride

##### B) Naming compounds that contain polyatomic ion

Polyatomic ion is an electrically charged combination of atoms. You should learn the names of common polyatomic ions (see the table). For a compound of a metal combined with a polyatomic ion, simply name the metal and then name the polyatomic ion.

$\text{Zn SO}_4$  zinc sulfate  
 $\text{Mg (NO}_3)_2$  magnesium nitrate

##### C) Naming compounds with transitional metals

Transition metals form more than one compound with a given nonmetal or polyatomic ion. To distinguish the compounds, the Stock System is used; that is a Roman numeral giving the value of the metal's ionic charge is placed in parentheses directly after the metal's name.

$\text{CrCl}_2$  chromium(II) chloride  
 $\text{CrCl}_3$  chromium(III) chloride

**D) Prior to** the development of the Stock System, another method was used to name ionic compounds containing metals that form two cations. In this system, which is still sometimes encountered, the ion with the lower charge is given a name ending in *-ous*, and the ion with the higher charge has a name ending in *-ic*. Often, the Latin name of the metallic element is used.

$\text{CrCl}_2$  chromous chloride  
 $\text{CrCl}_3$  chromic chloride

##### E) Naming compounds of two nonmetals

In a compound of two nonmetals, the less nonmetallic element (the one further to the left or further down in the periodic table) is usually written first in the formula and named first. The second element is named using *-ide* ending. Generally, two nonmetallic elements form several binary compounds, which are distinguished by using Greek prefixes to designate the number of atoms of the element that occur in the molecule. The prefix *mono* is always omitted from the name of the first element in the compound and is usually omitted from the second (with the exception of carbon monoxide, CO).

$\text{CS}_2$  carbon disulfide  
 $\text{H}_2\text{S}$  dihydrogen sulfide  
 $\text{IF}_7$  iodine heptafluoride

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**Revision of element's names: Which specific elements are meant by the underlined parts below?**



It was used for the filaments of old-style incandescent light bulbs. A noble gas was inside where the intense heat would cause the filament to react with oxygen and quickly deteriorate.

**5. PRACTICE: With the help of the diagram, name the following compounds:**

CaCl <sub>2</sub>	SO <sub>2</sub>	KNO <sub>3</sub>	NH <sub>4</sub> NO <sub>3</sub>	FeCl <sub>3</sub>	NO <sub>2</sub>
CaSO <sub>4</sub>	Na <sub>2</sub> CO <sub>3</sub>	NaHCO <sub>3</sub>	CCl <sub>4</sub>	Mg <sub>3</sub> N <sub>2</sub>	SF <sub>6</sub>
Al <sub>2</sub> O <sub>3</sub>	CsBr	Na <sub>2</sub> S	P <sub>4</sub> O <sub>10</sub>	Mg(OH) <sub>2</sub>	K <sub>3</sub> PO <sub>4</sub>
SO <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>			N <sub>2</sub> O	CuF <sub>2</sub>

*Is it a binary compound?*

**YES**

**NO**

*Is it a compound of a metal and non-metal?*

Name the cation, then the polyatomic ion

1. Na<sub>2</sub>CO<sub>3</sub> sodium carbonate

2.

3.

4.

5.

6.

7.

**YES**

name the metal, then the non-metal with -ide suffix

1. CaCl<sub>2</sub> calcium chloride

2.

3.

4.

5.

6.

7.

8.

**NO** – two non-metals

Name the 1st non-metal + the 2nd non-metal with -ide

**USE GREEK PREFIXES**

1. SO<sub>3</sub> sulfur trioxide

2.

3.

4.

5.

6.

7.

Metals that form more types of ions		
<i>ion</i>	<i>systematic</i>	<i>older</i>
Fe <sup>3+</sup>	iron (III)	ferric
Fe <sup>2+</sup>	iron (II)	ferrous
Cu <sup>2+</sup>	copper(II)	cupric
Cu <sup>+</sup>	copper(I)	cuprous
Pb <sup>4+</sup>	lead(IV)	plumbic
Pb <sup>2+</sup>	lead(II)	plumbous
Au <sup>+</sup>	gold(I)	aurous
Au <sup>3+</sup>	gold(III)	auric

The -ide nomenclature for nonmetal ions		
chlorine	chloride	Cl <sup>-</sup>
fluorine	fluoride	F <sup>-</sup>
hydrogen	hydride	H <sup>-</sup>
iodine	iodide	I <sup>-</sup>
nitrogen	nitride	N <sup>-III</sup>
oxygen	oxide	O <sup>-II</sup>
phosphorus	phosphide	P <sup>-III</sup>
sulfur	sulfide	S <sup>-II</sup>

Greek prefixes	
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6
hepta-	7
octa-	8
nona-	9
deca-	10

Some common polyatomic ions	
OH <sup>-</sup>	hydroxide
NO <sub>3</sub> <sup>-</sup>	nitrate
CO <sub>3</sub> <sup>2-</sup>	carbonate
SO <sub>4</sub> <sup>2-</sup>	sulfate
PO <sub>4</sub> <sup>3-</sup>	phosphate
NO <sub>2</sub> <sup>-</sup>	nitrite
SO <sub>3</sub> <sup>2-</sup>	sulfite
ClO <sub>3</sub> <sup>-</sup>	chlorate
ClO <sub>2</sub> <sup>-</sup>	chlorite
HCO <sub>3</sub> <sup>-</sup>	hydrogencarbonate, bicarbonate
NH <sub>4</sub> <sup>+</sup>	ammonium

**6. Mini-presentation on a topic for the oral exam (5 min, a speech without slides)**

1. **Define** two terms from your field of study and support them with relevant examples.
2. **Present a (controversial) problem** related to your field of study.
3. **Describe and explain a process** / notion / experiment within your field of study.
4. **Compare and contrast** phenomena from your field of study.
5. **Classify** systems in your field of study.
6. **Describe a cause and effect** relationship from your field of study.
7. **Speculate** on an issue from your field of study.

**In pairs, suggest a topic / some topics you can use for each of the points 1 – 7 above. Some of them has been offered, add your ideas.**

1. Different types of bonds, ...

2.

3. An experiment, ...

4. Two chemical compounds, e.g. CO and CO<sub>2</sub>, ...

5.

6. Different ways to speed up chemical reactions, ...

7. What scientists considered and speculated about when developing the atomic theory, ...

**Choose 2 topics and prepare to talk about them in Week 12 (30 Nov – 2 Dec)**