

Formulas for Ionic Compounds

Monatomic ions

a one atom ion

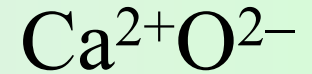
1A							8A
H ⁺	2A	3A	4A	5A	6A	7A	
Li ⁺				N ³⁻	O ²⁻	F ⁻	
Na ⁺	Mg ²⁺	Al ³⁺		P ³⁻	S ²⁻	Cl ⁻	
K ⁺	Ca ²⁺				Se ²⁻	Br ⁻	
Rb ⁺	Sr ²⁺					I ⁻	

Examples of binary compounds of metals

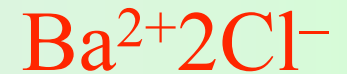
sodium bromide:



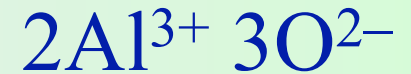
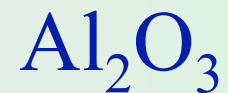
calcium oxide:



barium chloride:



aluminum oxide:



number of positive charges must equal number of negative charges

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write the formula for the following ionic pairs

19. potassium and iodide



Answer: KI

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write the formula for the following ionic pairs

20. magnesium and chloride



Answer: MgCl_2

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write the formula for the following ionic pairs

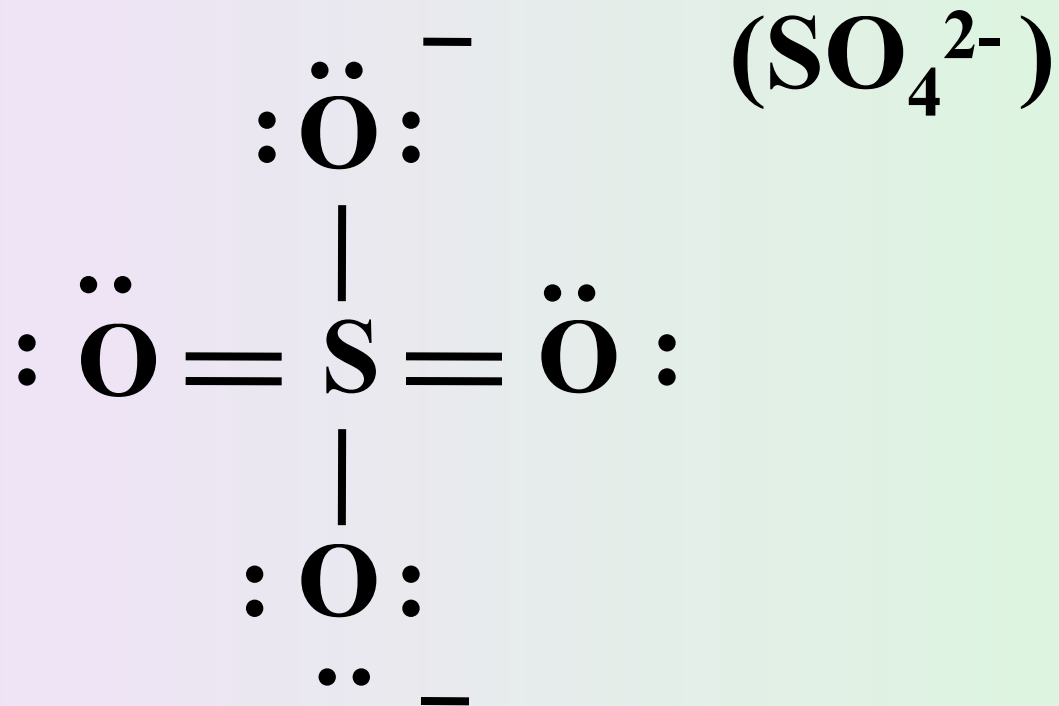
21. aluminum and bromide



Answer: AlBr_3

Polyatomic Ions

molecules with a charge

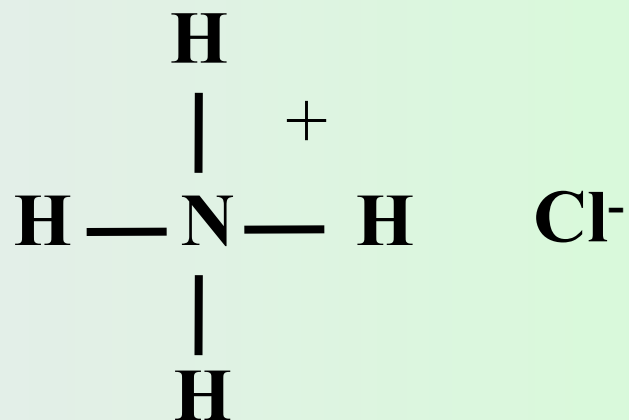


Polyatomic ions

Ionic bonding involving polyatomic ions is some what ambiguous


example (ammonium-chloride) NH_4Cl

being that NH_4^+ is held together by covalent bonds



Common Polyatomic Ions

$C_2H_3O_2^-$	acetate	OH^-	hydroxide
NH_4^+	ammonium	ClO^-	hypochlorite
CO_3^{2-}	carbonate	NO_3^-	nitrate
ClO_3^-	chlorate	NO_2^-	nitrite
ClO_2^-	chlorite	$C_2O_4^{2-}$	oxalate
CrO_4^{2-}	chromate	ClO_4^-	perchlorate
CN^-	cyanide	MnO_4^-	permanganate
$Cr_2O_7^{2-}$	dichromate	PO_4^{3-}	phosphate
HCO_3^-	bicarbonate	SO_4^{2-}	sulfate
HSO_4^-	bisulfate	SO_3^{2-}	sulfite
HSO_3^-	bisulfite		

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write the formula for the following ionic pairs

24. sodium and nitrate

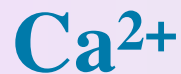


Answer: NaNO_3

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write the formula for the following ionic pairs

25. calcium and chlorate



Answer: $\text{Ca}(\text{ClO}_3)_2$

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write the formula for the following ionic pairs

26. aluminum and carbonate



Answer: $\text{Al}_2(\text{CO}_3)_3$

Naming Inorganic Compounds

common names

systematic names

Molecular
Formula

Common
name

Systematic
name

AgCl

Lunar caustic

Silver chloride

H₂SO₄

Oil of vitriol

Sulfuric acid

MgSO₄

Epsom salts

Magnesium sulfate

Nonenclature

When naming chemical compounds we distinguish between

Organic compounds

- compounds containing carbon.

Exceptions: CO, CO₂, CS₂, CN⁻, CO₃²⁻, HCO₃⁻, H₂CO₃

Inorganic compounds

- all other compounds

we can break the naming of inorganic compounds into four categories:

Ionic compounds

Molecular compounds

Acids and Bases

Hydrates

Binary compounds contain two different elements

Examples: NaCl , FeBr_3 , Al_2O_3 , N_2O_5 , P_4O_{10}

Instead of concerning ourselves with whether the compound is ionic or molecular, let's reintroduce the idea of **electronegativity**.

Electronegativity

measure of an elements ability to attract electrons toward itself when bonded to another element

An electronegative element attracts electrons.

An electropositive element releases electrons.

decreasing
electronegativity

Increasing electronegativity



Group	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A		3B	4B	5B	6B	7B		8B		1B	2B	3A	4A	5A	6A	7A	8A
Period																			
1	1 <u>H</u>																		2 <u>He</u>
2	3 <u>Li</u>	4 <u>Be</u>												5 <u>B</u>	6 <u>C</u>	7 <u>N</u>	8 <u>O</u>	9 <u>F</u>	10 <u>Ne</u>
3	11 <u>Na</u>	12 <u>Mg</u>												13 <u>Al</u>	14 <u>Si</u>	15 <u>P</u>	16 <u>S</u>	17 <u>Cl</u>	18 <u>Ar</u>
4	19 <u>K</u>	20 <u>Ca</u>		21 <u>Sc</u>	22 <u>Ti</u>	23 <u>Y</u>	24 <u>Cr</u>	25 <u>Mn</u>	26 <u>Fe</u>	27 <u>Co</u>	28 <u>Ni</u>	29 <u>Cu</u>	30 <u>Zn</u>	31 <u>Ga</u>	32 <u>Ge</u>	33 <u>As</u>	34 <u>Se</u>	35 <u>Br</u>	36 <u>Kr</u>
5	37 <u>Rb</u>	38 <u>Sr</u>		39 <u>Y</u>	40 <u>Zr</u>	41 <u>Nb</u>	42 <u>Mo</u>	43 <u>Tc</u>	44 <u>Ru</u>	45 <u>Rh</u>	46 <u>Pd</u>	47 <u>Ag</u>	48 <u>Cd</u>	49 <u>In</u>	50 <u>Sn</u>	51 <u>Sb</u>	52 <u>Te</u>	53 <u>I</u>	54 <u>Xe</u>
6	55 <u>Cs</u>	56 <u>Ba</u>	*	71 <u>Lu</u>	72 <u>Hf</u>	73 <u>Ta</u>	74 <u>W</u>	75 <u>Re</u>	76 <u>Os</u>	77 <u>Ir</u>	78 <u>Pt</u>	79 <u>Au</u>	80 <u>Hg</u>	81 <u>Tl</u>	82 <u>Pb</u>	83 <u>Bi</u>	84 <u>Po</u>	85 <u>At</u>	86 <u>Rn</u>
7	87 <u>Fr</u>	88 <u>Ra</u>	**	103 <u>Lr</u>	104 <u>Rf</u>	105 <u>Db</u>	106 <u>Sg</u>	107 <u>Bh</u>	108 <u>Hs</u>	109 <u>Mt</u>	110 <u>Uun</u>	111 <u>Uuu</u>	112 <u>Uub</u>	113 <u>Uut</u>	114 <u>Uuq</u>	115 <u>Uup</u>	116 <u>Uuh</u>	117 <u>Uus</u>	118 <u>Uuo</u>
lanthanides			*	57 <u>La</u>	58 <u>Ce</u>	59 <u>Pr</u>	60 <u>Nd</u>	61 <u>Pm</u>	62 <u>Sm</u>	63 <u>Eu</u>	64 <u>Gd</u>	65 <u>Tb</u>	66 <u>Dy</u>	67 <u>Ho</u>	68 <u>Er</u>	69 <u>Tm</u>	70 <u>Yb</u>		
actinides			**	89 <u>Ac</u>	90 <u>Th</u>	91 <u>Pa</u>	92 <u>U</u>	93 <u>Np</u>	94 <u>Pu</u>	95 <u>Am</u>	96 <u>Cm</u>	97 <u>Bk</u>	98 <u>Cf</u>	99 <u>Es</u>	100 <u>Fm</u>	101 <u>Md</u>	102 <u>No</u>		

Naming Ionic Compounds

Naming binary compounds

binary compounds contain two elements

and are named as two words

first word is name of more **electropositive element**

second word is first part of name of more **electronegative element followed by **-ide****

Common Monatomic Cations

+1: H

+1: Li, Na, K, Cs

+2: Mg, Ca, Ba

+3: Al

Common Monatomic Anions

-1: F, Cl, Br, I

-2: O, S

-3: N, P

Example

Write the formulas for the following compounds:

(a) potassium sulfide



Answer: K_2S

Example

But some metals can form more than one type of cation

Often, but not always, a transition metal

Binary compounds of metals (cont'd)

When metal can form more than one type of cation, indicate charge by Roman numeral in parenthesis

MnO manganese(II) oxide

Mn₂O₃ manganese(III) oxide

MnO₂ manganese(IV) oxide

use of the suffixes -ous and -ic is discouraged

Commonly encountered cations that can exist as two different charge types

+1, +2: Cu, Hg

+2, +3: Fe, Co

+2, +4: Sn, Pb

Example

Write the formulas for the following compounds:

(a) tin(II) fluoride



Answer: SnF_2

Example

Write the formulas for the following compounds:

(a) mercury(II) oxide



Answer: HgO

Example

Write the formulas for the following compounds:

(a) mercury(I) iodide

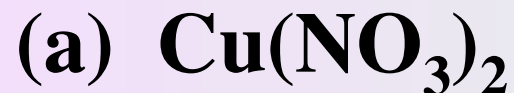
Hg⁺ actually exists as Hg₂²⁺

I⁻

Answer: Hg₂I₂

Example

Name the following ionic compounds:



Answer: copper(II)nitrate