

Lewis dot structure N
covalent electrons stability requires
H: N:H
H - N-H
H NH3 Optim #1: steal
H - N-H
Create ion
Optim #2: share
Ammonica
H - N-H
NH4 - ammonivm
H
Find the Ionic Compound for
calcium bromide
$$35^{\oplus}35e^{\oplus}$$

 Ca^{+2} Br Bromine + e^{\oplus}
Fe⁺² F⁻¹ CaBr₂
From (II) Flueride Fe^{+2} F⁻¹
Ionic formula Fe^{+2} F⁻¹











Draw







Lewis





A polyatomic ion contains more than one atom many OH- CN-, NH₄+, NO₃nifrate hydroxide cyanide ammonium

Common Ions Shown on the Periodic Table																	
	+2				(τ)	- 4	+2					+3		_3	-2	_1	18 8A
	2 2A		/Nei	rcurg	(μ) π)	Iron	ge NII)	-> F	-e+2			13 3A	14 4A	15 5A	10 6A	17 7A	
Li+			//001	H	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	In	on	<u>1)</u>	fet	3			X	N ³⁻	O ^{2–}	F-	
Na ⁺	Mg ²⁺	3 3B	4 4B	5 5B	6 6B	7 7B		9 	10	11 1B	12 2B	Al ³⁺	/ \	P ³⁻	S ²⁻	Cl-	
K+	Ca ²⁺				Cr ²⁺ Cr ³⁺	Mn ²⁺ Mn ³⁺	Fe ²⁺ Fe ³⁺	Co ²⁺ Co ³⁺	Ni ²⁺ Ni ³⁺	Cu ⁺ Cu ²⁺	Zn ²⁺				Se ^{2–}	Br-	
Rb+	Sr ²⁺									Ag ⁺	Cd ²⁺		Sn ²⁺ Sn ⁴⁺		Te ^{2–}	I-	
Cs+	Ba ²⁺									Au ⁺ Au ³⁺	Hg ₂ ²⁺ Hg ²⁺		Pb ²⁺ Pb ⁴⁺				



34 protons, 36 (34 + 2) electrons

Formulas and Models



A *molecular formula* shows the exact number of atoms of each element in the smallest unit of a substance

An *empirical formula* shows the <u>simplest</u> whole-number ratio of the atoms in a substance



ionic compounds consist of a combination of cations and an anions

- The formula is usually the same as the empirical formula
- The sum of the charges on the cation(s) and anion(s) in each formula unit must equal zero $\sqrt{1 - 1} = \sqrt{1 - 1} = \sqrt{1$

The ionic compound NaCl









The most reactive **metals** (green) and the most reactive **nonmetals** (blue) combine to form ionic compounds.

Formula of Ionic Compounds







Chemical Nomenclature

Ionic Compounds

- Often a metal + nonmetal
- Anion (nonmetal), add "ide" to element name



cation anion barium chloride potassium oxide magnesium hydroxide potassium nitrate Transition metal ionic compounds

- indicate charge on metal with Roman numerals



TABLE 2.2The Accord	The "-ide" Nomenclature of Some Common Monatomic Anions According to Their Positions in the Periodic Table						
Group 4A	Group 5A	Group 6A	Group 7A				
C carbide (C ⁴⁻)* Si silicide (Si ⁴⁻)	N nitride (N ³⁻) P phosphide (P ³⁻)	O oxide (O ²⁻) S sulfide (S ²⁻) Se selenide (Se ²⁻) Te telluride (Te ²⁻)	F fluoride (F ⁻) Cl chloride (Cl ⁻) Br bromide (Br ⁻) I iodide (I ⁻)				

*The word "carbide" is also used for the anion C_2^{2-} .

	Cation	Anion
	aluminum (Al ³⁺)	bromide (Br ⁻) - pt
C	ammonium (NH ⁺ ₄)	carbonate (CO_3^2)
	barium (Ba ²⁺)	chlorate (ClO_3^-)
	cadmium (Cd ²⁺)	chloride (Cl ⁻)
10	calcium (Ca ²⁺)	chromate (CrO_4^2)
X	cesium (Cs ⁺)	cyanide (CN ⁻)
$\gamma < 0$	chromium(III) or chromic (Cr ³⁺)	dichromate $(Cr_2O_7^{2-})$
j j	cobalt(II) or cobaltous (Co ²⁺)	dihydrogen phosphate $(H_2PO_4^-)$
	copper(I) or cuprous (Cu ⁺)	fluoride (F ⁻)
	copper(II) or cupric (Cu ²⁺)	hydride (H ⁻)
<u> </u>	hydrogen (H ⁺)	hydrogen carbonate or bicarbonate (HCO ₃)
	iron(II) or ferrous (Fe ²⁺)	(hydrogen phosphate (HPO $_4^2$))
	iron(III) or ferric (Fe ³⁺)	hydrogen sulfate of bisulfate (HSO_4^-)
	lead(II) or plumbous (Pb ²⁺)	hydroxide (OH)
	lithium (Li ⁺)	iodide (I ⁻)
	magnesium (Mg ²⁺)	(NO_3)
	manganese(II) or manganous (Mn ²⁺)	nitride (N^{3-})
	mercury(I) or mercurous $(Hg_2^{2+})^*$	(NO_2)
	mercury(II) or mercuric (Hg ²⁺)	oxide (O^{2-})
	potassium (K ⁺)	permanganate (MnO_4^-)
	rubidium (Rb ⁺)	peroxide $(O_2^{2^-})$
	silver (Ag ⁺)	phosphate (PO_4^{3-})
	sodium (Na ⁺)	(SO_4^{2-})
	strontium (Sr ²⁺)	sulfide (S^{2-})
	tin(II) or stannous (Sn ²⁺)	sulfite (SO_2^{2-})
	zinc (Zn^{2+})	(thiocyanate (SCN ⁻))

Names and Formulas of Some Common Inorganic Cations

TABLE 2.3

Molecular compounds	TABLE 2.4	
 Nonmetals or nonmetals + metalloids 	Greek Prefixes	Used in
- Common names	Naming Molecu Compounds	ılar
 Element furthest to the left in a period 	Prefix	Meaning
and closest to the bottom of a group on	mono-	1
periodic table is placed first in formula	ai- tri-	2 3
– If more than one compound can be	tetra-	4
formed from the same elements, use \checkmark	penta-	5
prefixes to indicate number of each kind	hexa-	6 7
of atom	octa-	8
 Last element name ends in <i>ide</i> 	nona-	9
huse	deca-	10
Fun	sie	

Molecular Compounds

- HI hydrogen iodide
- NF₃ nitrogen trifluoride
- SO₂ sulfur dioxide
- N₂Cl₄ dinitrogen tetrachloride
- NO₂ nitrogen dioxide
- N₂O dinitrogen monoxide



An **acid** can be defined as a substance that yields hydrogen ions (H⁺) when dissolved in water. For example: HCI gas and HCI in water

•Pure substance, hydrogen chloride HCl

HCl -> H^D + Cl Lindicative of acid •Dissolved in water (H₃O+ and Cl⁻), hydrochloric acid



TABLE 2.5Some Simple Acids

AnionCorres F^- (fluoride)HF (hyd Cl^- (chloride)HF (hyd Br^- (bromide)HCl (hy I^- (iodide)HBr (hy CN^- (cyanide)HCN (h S^{2^-} (sulfide)H_2S (hy

Corresponding Acid

HF (hydrofluoric acid)
HCl (hydrochloric acid)
HBr (hydrobromic acid)
HI (hydroiodic acid)
HCN (hydrocyanic acid)
H₂S (hydrosulfuric acid)

An **oxoacid** is an acid that contains hydrogen, oxygen, and another element.





 H_3PO_4

Naming Oxoacids and Oxoanions



The rules for naming **oxoanions**, anions of oxoacids, are as follows:

- 1. When all the H ions are removed from the "ic" acid, the anion's name ends with "-ate."
- 2. When all the H ions are removed from the "ous" acid, the anion's name ends with "-ite."
- 3. The names of anions in which one or more but not all the hydrogen ions have been removed must indicate the number of H ions present.
 - For example:
 - $-H_2PO_4^-$ dihydrogen phosphate
 - HPO₄ ²⁻ hydrogen phosphate
 - PO₄³⁻ phosphate

TABLE 2.6 Names of Oxoacids and Oxoanions That Contain Chlorine

Acid	Anion
HClO ₄ (perchloric acid)	ClO_4^- (perchlorate)
HClO ₃ (chloric acid)	ClO_3^- (chlorate)
HClO ₂ (chlorous acid)	ClO_2^- (chlorite)
HClO (hypochlorous acid)	ClO ⁻ (hypochlorite)



Hydrates are compounds that have a specific number of water molecules attached to them.

- $BaCl_2 \cdot 2H_2O$ barium chloride dihydrate
- LiCl•H₂O lithium chloride monohydrate
- MgSO₄•7H₂O magnesium sulfate heptahydrate
- $Sr(NO_3)_2 \cdot 4H_2O$ strontium nitrate tetrahydrate







TABLE 2.7 Common and Systematic Names of Some Compounds

Formula	Common Name	Systematic Name
H ₂ O	Water	Dihydrogen monoxide
NH ₃	Ammonia	Trihydrogen nitride
CO_2	Dry ice	Solid carbon dioxide
NaCl	Table salt	Sodium chloride
N_2O	Laughing gas	Dinitrogen monoxide
CaCO ₃	Marble, chalk, limestone	Calcium carbonate
CaO	Quicklime	Calcium oxide
Ca(OH) ₂	Slaked lime	Calcium hydroxide
NaHCO ₃	Baking soda	Sodium hydrogen carbonate
$Na_2CO_3 \cdot 10H_2O$	Washing soda	Sodium carbonate decahydrate
$MgSO_4 \cdot 7H_2O$	Epsom salt	Magnesium sulfate heptahydrate
Mg(OH) ₂	Milk of magnesia	Magnesium hydroxide
$CaSO_4 \cdot 2H_2O$	Gypsum	Calcium sulfate dihydrate

Organic chemistry is the branch of chemistry that deals with carbon compounds





TABLE 2.8 The First Ten Straight-Chain Alkanes