Ch. 8.3 chemical name / formula: ionic compounds

background / review:

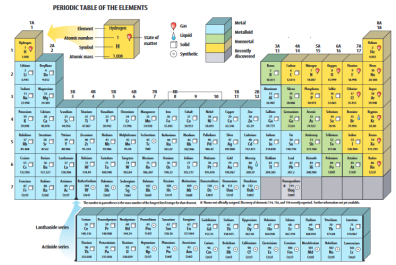

Figure 6-4

source: https://vdocuments.site/glencoe-chemistry-matter-and-change.html

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recall: electronegativity = how much an atom "wants" another atom's electron.

Ionic compounds

contains ions

cation (+) & anion (-)

or contains metal + nonmetal

or Δ EN = big; i.e. "far" apart in the periodic table

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Background: chemical formula

e.g. H_2O & $Ca(NO_3)_2$

uses:

chemical symbols

to identify the atom(s) in the chemical

and superscripts

to identify the number of those atom(s) in the chemical

so

* H_2O has 2- hydrogen atoms and 1- oxygen atom in a single molecule
* $Ca(NO_3)_2$ = Ca & NO_3 & NO_3 has 1-calcium, 2-nitrogen, & 6-oxygen atoms in a single molecule

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aside / background: molecule versus compound

	Molecule ?	Compound ?
O_2	yes	no
H_2O	yes	yes

based on the information in the above table, differentiate between a molecule versus compound.

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Table of ions -- memorize

Table 8-4

Common Ions Based on Groups		
Group	Atoms that commonly form ions	Charge on ions
1A	H, Li, Na, K, Rb, Cs	1+
2A	Be, Mg, Ca, Sr, Ba	2+
5A	N, P, As	3−
6A	O, S, Se, Te	2−
7A	F, Cl, Br, I	1−

Table 8-5

Common Ions of Transition Metals and Groups 3A and 4A	
Group	Common ions
3B	Sc^{3+}, Y^{3+}, La^{3+}
4B	Ti^{2+}, Ti^{3+}
5B	V^{2+}, V^{3+}
6B	Cr^{2+}, Cr^{3+}
7B	Mn^{2+}, Mn^{3+}, Tc^{2+}
8B	Fe^{2+}, Fe^{3+}
8B	Co^{2+}, Co^{3+}
8B	Ni^{2+}, Pd^{2+}, Pt^{2+}, Pt^{4+}
1B	Cu^{+}, Cu^{2+}, Ag^{+}, Au^{+}, Au^{3+}
2B	Zn^{2+}, Cd^{2+}, Hg_2^{2+}, Hg^{2+}
3A	Al^{3+}, Ga^{3+}, In^{+}, In^{2+}, In^{3+}, Tl^{+}, Tl^{3+}
4A	Sn^{2+}, Sn^{4+}, Pb^{2+}, Pb^{4+}

Table 8-6

Common Polyatomic Ions			
Ion	Name	Ion	Name
NH_4^+	ammonium	IO_4^-	periodate
NO_2^-	nitrite	$C_2H_3O_2^-$	acetate
NO_3^-	nitrate	$H_2PO_4^-$	dihydrogen phosphate
HSO_4^-	hydrogen sulfate	CO_3^{2-}	carbonate
OH^-	hydroxide	SO_3^{2-}	sulfite
CN^-	cyanide	SO_4^{2-}	sulfate
MnO_4^-	permanganate	$S_2O_3^{2-}$	thiosulfate
HCO_3^-	hydrogen carbonate	O_2^{2-}	peroxide
ClO^-	hypochlorite	CrO_4^{2-}	chromate
ClO_2^-	chlorite	$Cr_2O_7^{2-}$	dichromate
ClO_3^-	chlorate	HPO_4^{2-}	hydrogen phosphate
ClO_4^-	perchlorate	PO_4^{3-}	phosphate
BrO_3^-	bromate	AsO_4^{3-}	arsenate
IO_3^-	iodate		

source: https://vdocuments.site/glencoe-chemistry-matter-and-change.html

also: http://chem-is-try.us/class/ap/supplement/various%20topics/NIE-tables.htm ← responsible for content, here, regarding table of ions

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note: pattern in periodic table

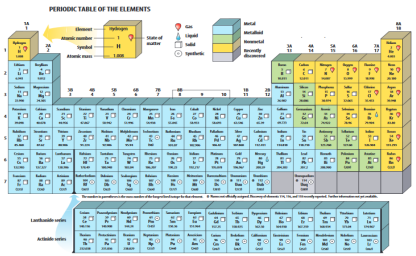

Figure 6-4

charge / name of cations:

atom name = cation name

column # from left = charge

charge / name of anions:

anion name = atom name, where sometimes change "-ine" to "-ide"

column # from right = charge

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Chemical formula → chemical name I

recall: ionic compound = cation + anion

so chemical name (of an ionic compound) = name of cation + name of anion

examples:

$NaBr$ = sodium bromide

$CaCl_2$ = calcium chloride

$Mg_3(PO_4)_2$ = magnesium phosphate

SnH_4 = tin (IV) hydride

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Chemical formula → chemical name II

recall: some cations have more than one possible charge

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1B	Cu^{+}, Cu^{2+}, Ag^{+}, Au^{+}, Au^{3+}
2B	Zn^{2+}, Cd^{2+}, Hg_2^{2+}, Hg^{2+}
3A	Al^{3+}, Ga^{3+}, In^{+}, In^{2+}, In^{3+}, Tl^{+}, Tl^{3+}
4A	Sn^{2+}, Sn^{4+}, Pb^{2+}, Pb^{4+}

exception: use Roman numerical to identify the charge of cations with more than one possible charge.

examples:

$FeCl_3$ = $Fe^{?}$ & 3, Cl^{-}; so Fe has charge of + 3; so it's name is iron (III) chloride

CuS = $Cu^{?}$ & S^{2-}; so, Cu has a charge of +2, so it's name is copper (II) sulfide

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Chemical name → chemical formula

recall: chemical name (of an ionic compound) = name of cation + name of anion

likewise,

chemical symbol (i.e. formula of an ionic compound) = symbol of cation + symbol of anion

and use lowest ratio of integer subscripts to "balance" the charges;

i.e. charge of cation = charge of anion

examples:

* barium chloride has Ba^{2+} & Cl^- → to balance charges, need 1- Ba^{2+} & 2- Cl^-

→ $BaCl_2$

* lanthanum nitrate has La^{3+} & NO_3^- → to balance charges, need 1- La^{3+} & 3-NO_3^-

→ $La(NO_3)_3$

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more examples: chemical name → chemical formula

* copper (II) phosphate has Cu^{2+} & PO_4^{-3} → to balance charges, need

3-Cu^{2+} & 2- PO_4^{-3} → Cu^{2+} Cu^{2+} Cu^{2+} PO_4^{-3} PO_4^{-3}

charge of cations = + 6 charge of anions = -6

→ $Cu_3(PO_4)_2$

"criss-cross rule": usually,

the charge of the cation = subscript of the anion

the (magnitude) charge of the anion = subscript of the cation

e.g. Copper (II) phosphate: Cu^{2+} & PO_4^{-3} → $Cu_3(PO_4)_2$

exception: must use lowest integer ratio of subscript

e.g. Magnesium oxide → Mg^{2+} & O^{2-} → is not Mg_2O_2, but it is MgO

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