

# Memorized Names

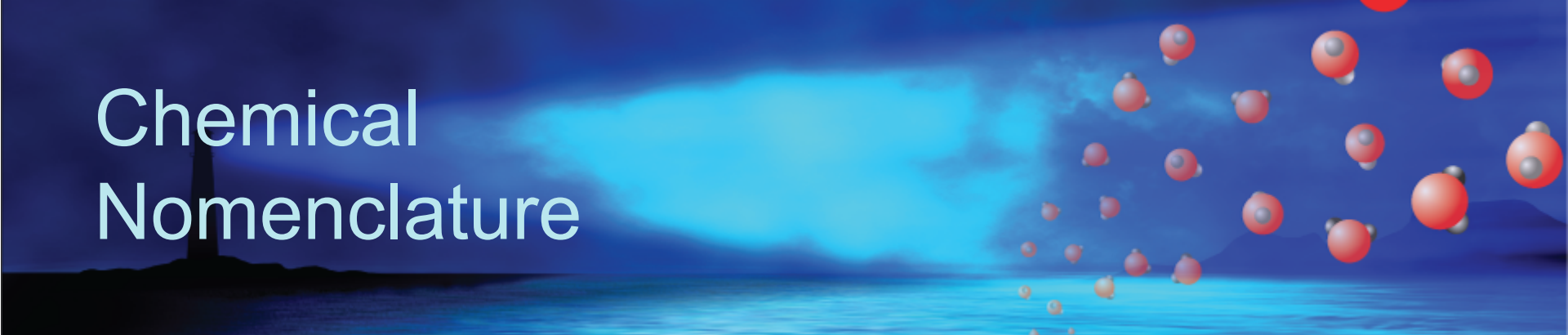
Name	Formula	Name	Formula
water	$\text{H}_2\text{O}$	ammonia	$\text{NH}_3$
methane	$\text{CH}_4$	ethane	$\text{C}_2\text{H}_6$
propane	$\text{C}_3\text{H}_8$	methanol (methyl alcohol)	$\text{CH}_3\text{OH}$
ethanol (ethyl alcohol)	$\text{C}_2\text{H}_5\text{OH}$	2-propanol (isopropyl alcohol)	$\text{C}_3\text{H}_7\text{OH}$

# Periodic Table

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

[https://preparatorychemistry.com/Bishop\\_periodic\\_table.pdf](https://preparatorychemistry.com/Bishop_periodic_table.pdf)

# Chemical Nomenclature



- General procedure for naming compounds
  - **Step 1:** Decide what type of compound the name or formula represents.
  - **Step 2:** Apply the rules for writing the name or formula for that type of compound.

# Table 6.13 (atoms) or 5.5 (chemistry)

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

# Practice



- The web address below will take you to tool that will help you recognize different types of substances.

[https://preparatorychemistry.com/Type\\_substance\\_Canvas.html](https://preparatorychemistry.com/Type_substance_Canvas.html)

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$  <b><math>AlF_3</math></b>	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
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- Metal-nonmetal ( $\text{M}_a\text{A}_b$ ) so binary ionic
- Al only one charge – just name of metal with no Roman numeral.
  - Metals without Roman numerals – Groups 1, 2, 3, and Al, Zn, Cd, and Ag
- The cation name is aluminum.
- Monatomic anion names – (root)ide
- Name of the anion is fluoride.
- **Aluminum fluoride**

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$  <b>PF<sub>3</sub></b>	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid





- Nonmetal-nonmetal ( $A_aB_b$ ) so binary covalent.
- (prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide
- Leave off mono on first part of name.
- We use the prefix tri- to show three fluorine atoms.
- The root of the name fluorine is fluor-
- **Phosphorus trifluoride**

# Nomenclature Summary

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Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$  $H_3PO_4$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid



- Form of oxyacid,  $\text{H}_a\text{X}_b\text{O}_c$
- (root)ic acid
- Use “phosphor” as the root in acid names.
- $\text{H}_3\text{PO}_4$  is **phosphoric acid**.

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Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion  <b><math>CaCO_3</math></b>	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid



# Periodic Table

$\text{Ca}^{2+}$  named calcium

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



Ion	Name	Ion	Name
$\text{NH}_4^+$	ammonium	$\text{NO}_3^-$	nitrate
$\text{OH}^-$	hydroxide	$\text{SO}_4^{2-}$	sulfate
$\text{CO}_3^{2-}$	carbonate	$\text{C}_2\text{H}_3\text{O}_2^-$	acetate
$\text{PO}_4^{3-}$	phosphate		



- Metal polyatomic ion ( $\text{M}_a\text{X}_b$ ) with X representing a polyatomic ion
- Ca is in Group 2, so the cation name is just the name of the metal.
- Need to memorize polyatomic names and formulas.
- $\text{CaCO}_3$  is **calcium carbonate**.

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Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid







- The name for the cation is calcium.
- Memorize  $\text{SO}_4^{2-}$  as sulfate.
- When a polyatomic anion with a charge of -2 has an  $\text{H}^+$  added, we add “hydrogen” to the name of the anion.
- $\text{Ca}(\text{HSO}_4)_2$  is **calcium hydrogen sulfate**.

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Binary ionic	$M_aA_b$  <b><math>CuCl_2</math></b>	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

# Periodic Table

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



- Metal-nonmetal ( $M_aA_b$ ) so binary ionic
- Cu is not on the list of metals without a Roman numeral, so we need a Roman numeral to show the charge.
- Cl is in group 17, so it is -1.
- Two  $\text{Cl}^-$  ions would be -2.
- Cu must be +2 to balance the charge, so the name of the cation is copper(II).
- Monatomic anions are named (root)ide, so  $\text{Cl}^-$  is chloride.
- $\text{CuCl}_2$  is **copper(II) chloride**.

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Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion  <b><math>NH_4F</math></b>	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid



- Polyatomic ion-nonmetal so ionic with a polyatomic ion.
- Memorize  $\text{NH}_4^+$  as ammonium.
- Monatomic anions are named (root)ide.
- $\text{NH}_4\text{F}$  is **ammonium fluoride**.

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Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion  <b>HCl(aq)</b>	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid



$\text{HCl}(aq)$

- $\text{HX}(aq)$  is the form of a binary acid.
- Named hydro(root)ic acid
- $\text{HCl}(aq)$  is **hydrochloric acid**.



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Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid





- Two polyatomic ions so ionic with polyatomic ions.
- Need to memorize names and formulas for polyatomic ions.
- $(\text{NH}_4)_3\text{PO}_4$  is **ammonium phosphate**.

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
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Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

**Ammonium nitrate**

# Steps for Ionic Formulas

The background of the slide features a sunset over a body of water. The sky is a gradient of blue and orange, with a bright sun partially obscured by clouds. In the foreground, the water is dark blue. Numerous water molecules, represented by red and white spheres, are scattered across the scene, appearing to float or rise from the water.

- The steps for writing formulas for ionic compounds are
  - Determine the formula, including charge, for the ions.
  - Determine the ratio of the ions necessary to balance the charge.

# ammonium nitrate

- Ammonium and nitrate are both polyatomic ions.
- The memorized formula for ammonium is  $\text{NH}_4^+$ .
- The memorized formula for nitrate is  $\text{NO}_3^-$ .
- A 1:1 ratio balances the charge.
- Ammonium nitrate is  **$\text{NH}_4\text{NO}_3$** . (Note no parentheses)

# acetic acid

- It is probably best to memorize acetic acid as  $\text{HC}_2\text{H}_3\text{O}_2$ . It is also described at  $\text{CH}_3\text{CO}_2\text{H}$ .
- $\text{C}_2\text{H}_3\text{O}_2^-$  is acetate.
- If you add enough  $\text{H}^+$  ions to the  $-ate$  anion to neutralize the charge, you get the  $-ic$  acid.
- Acetic acid is  **$\text{HC}_2\text{H}_3\text{O}_2$** .

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

sodium hydrogen sulfate

# sodium hydrogen sulfate

## Periodic Table

sodium ion – Na<sup>+</sup>

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



# sodium hydrogen sulfate

- “(name of metal) (name of polyatomic ion)”  
so ionic with a polyatomic ion.
- Sodium is in group 1, so it is +1.
- Sulfate is  $\text{SO}_4^{2-}$ .
- Assume one  $\text{H}^+$ .
- Adding one  $\text{H}^+$  to  $\text{SO}_4^{2-}$  yields  $\text{HSO}_4^-$ .
- Balance the charge.
- **$\text{NaHSO}_4$**

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

potassium bromide

# potassium bromide

## Periodic Table

potassium – K<sup>+</sup>

bromide – Br<sup>-</sup> 18  
8A

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

# potassium bromide

- “(name of metal) (root of nonmetal)ide” so binary ionic.
- K (for potassium) is in group 1, so the cation is  $K^+$ .
- Br (for bromine) is in group 17, so the anion is  $Br^-$ .
- One  $K^+$  balances the charge on one  $Br^-$ .
- Potassium bromide is **KBr**

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

magnesium  
dihydrogen phosphate

# magnesium dihydrogen phosphate

## Periodic Table

### magnesium – $Mg^{2+}$

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

# magnesium dihydrogen phosphate

- “(name of metal) (name of polyatomic ion)”  
so ionic with a polyatomic ion.
- Magnesium is in group 2, so it is +2.
- Phosphate is  $\text{PO}_4^{3-}$ .
- Adding two  $\text{H}^+$  ions to  $\text{PO}_4^{3-}$  yields  $\text{H}_2\text{PO}_4^-$ .
- Balance the charge.
- **$\text{Mg}(\text{H}_2\text{PO}_4)_2$**

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

**hydrofluoric acid**



# hydrofluoric acid

- “hydro(root)ic acid” so binary acid.
- Formulas for binary acids have the form  $\text{HX(aq)}$  or  $\text{H}_2\text{X(aq)}$ .
- Fluorine atoms only form one bond.
- Hydrofluoric acid is  **$\text{HF(aq)}$** .

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent <b>diphosphorus tetroxide</b>	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

# diphosphorus tetroxide

- “(prefix)(name of first element in formula) (prefix)(root of second element)ide” so binary covalent.
- di- represents 2.
- Phosphorus is P
- tetra- represents 4.
- ox- is O.
- Diphosphorus tetroxide is  $\text{P}_2\text{O}_4$ .

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

aluminum carbonate

# aluminum carbonate

## Periodic Table

aluminum –  $\text{Al}^{3+}$

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

# aluminum carbonate

- “(name of metal) (name of polyatomic ion)” so ionic with a polyatomic ion.
- Aluminum is Al. It forms  $\text{Al}^{3+}$  ions.
- Memorize carbonate as  $\text{CO}_3^{2-}$ .
- Cross the superscripts to get the subscripts for  $\text{Al}^{3+}$  and  $\text{CO}_3^{2-}$ .
- **$\text{Al}_2(\text{CO}_3)_3$**

# Nomenclature Summary

Type of Compound	General Formula	Examples	General Name	Examples
Binary covalent	$A_aB_b$	$N_2O_5$ or $CO_2$	(prefix unless mono)(name of first element in formula) (prefix)(root of second element)ide	dinitrogen pentoxide or carbon dioxide
Binary ionic	$M_aA_b$	$NaCl$ or $FeCl_3$	(name of metal) (root of nonmetal)ide <b>or</b> (name of metal)(Roman numeral) (root of nonmetal)ide	sodium chloride or iron(III) chloride
Ionic with polyatomic ion(s)	$M_aX_b$ or $(NH_4)_aX_b$  X = formula of polyatomic ion	$Li_2HPO_4$ or $CuSO_4$ or $NH_4Cl$ or $(NH_4)_2SO_4$	(name of metal) (name of polyatomic ion) <b>or</b> (name of metal)(Roman numeral) (name of polyatomic ion) <b>or</b> ammonium (root of nonmetal)ide <b>or</b> ammonium (name of polyatomic ion)	lithium hydrogen phosphate or copper(II) sulfate or ammonium chloride or ammonium sulfate
Binary acid	$HX(aq)$	$HCl(aq)$	hydro(root)ic acid	hydrochloric acid
Oxyacid  <b>sulfuric acid</b>	$H_aX_bO_c$	$HNO_3$ or $H_2SO_4$ or $H_3PO_4$	(root)ic acid	nitric acid or sulfuric acid or phosphoric acid

# sulfuric acid



- “(root)ic acid” without “hydro-” so oxyacid.
- Sulfate is  $\text{SO}_4^{2-}$ .
- Add enough  $\text{H}^+$  ions to neutralize charge.
- Sulfuric acid is  **$\text{H}_2\text{SO}_4$** .



# Practice



- There are two tools on the textbook website that will allow you to practice the tasks described in this lesson.
  - Identification of types of substances  
[https://preparatorychemistry.com/Type\\_substance\\_Canvas.html](https://preparatorychemistry.com/Type_substance_Canvas.html)
  - Converting between names and formulas for compounds  
[https://preparatorychemistry.com/nomenclature\\_Canvas.html](https://preparatorychemistry.com/nomenclature_Canvas.html)