

Name \_\_\_\_\_

# #5 Nomenclature

## Quantitative Chemistry

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### Student Learning Map

**Unit EQ: How do I name and write formulas for chemical compounds?**

**Key Learning: Naming and writing formulas for compounds is a systematic process.**

#### UNIT CONCEPT:

<b>1. Type I Compounds</b>	<b>2. Type II Compounds</b>	<b>3. Type III Compounds</b>	<b>4. Acids</b>
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#### LESSON ESSENTIAL QUESTIONS:

a. How do I distinguish between Type I, II, III Compounds, and Acids?  b. How do I name and write formulas for Type I compounds?	How do I name and write formulas for Type II compounds?	How do I name and write formulas for Type III compounds?	How do I name and write formulas for acids?
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#### LESSON ESSENTIAL VOCABULARY:

Monatomic Ion Polyatomic Ion			Acid
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# 1a. Distinguishing Between Compounds

EQ: How do I distinguish between Type I, II, III Compounds and Acids?

## First Element:

Key																												
11		11		11		11		11		11		11		11		11												
Na		Na		Na		Na		Na		Na		Na		Na		Na												
Sodium		Sodium		Sodium		Sodium		Sodium		Sodium		Sodium		Sodium		Sodium												
22.99		22.99		22.99		22.99		22.99		22.99		22.99		22.99		22.99												
Average atomic mass*																												
1	1A																18	8A										
1	H																2	He										
	Hydrogen																	Helium										
	1.01																	4.00										
2	3	4																13	5A	14	6A	15	7A	16	8A	17	9A	10
	Li	Be																B	C	N	O	F	Ne					
	Lithium	Beryllium																Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon					
	6.94	9.01																10.81	12.01	14.01	16.00	19.00	20.18					
3	11	12																13	14	15	16	17	18					
	Na	Mg																Al	Si	P	S	Cl	Ar					
	Sodium	Magnesium																Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon					
	22.99	24.31																26.98	28.09	30.97	32.07	35.45	39.95					
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										
	Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton										
	39.10	40.08	44.96	47.87	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80										
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										
	Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon										
	85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.29										
6	55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86										
	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn										
	Cesium	Barium	Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon										
	132.91	137.33	138.91	178.49	180.95	183.84	186.21	190.23	192.22	195.08	196.97	200.59	204.38	207.2	208.98	(209)	(210)	(222)										
7	87	88	89	104	105	106	107	108	109																			
	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt																			
	Francium	Radium	Actinium	Rutherfordium	Dubnium	Seaborgium	Berkelium	Hassium	Moscovium																			
	(223)	(226)	(227)	(261)	(262)	(266)	(264)	(269)	(288)																			
	* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.																											
	58	59	60	61	62	63	64	65	66	67	68	69	70	71														
	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu														
	Cerium	Praseodymium	Niodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium														
	140.12	140.91	144.24	(145)	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04	174.97														
	90	91	92	93	94	95	96	97	98	99	100	101	102	103														
	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr														
	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lanthanum														
	232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)														

## Polyatomic Ion: NH<sub>4</sub><sup>+</sup>

TYPE I:	TYPE II:	TYPE III:	ACIDS:
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# 1a. Distinguishing Between Compounds (cont.)

## Second Element(s):

### Monatomic Ions:

Key																			
11	Atomic number		Element symbol		Element name		Average atomic mass*												
Na	Sodium		22.99																
1	1A	2	3A	4A	5A	6A	7A	8A										18	8A
1	H	2	He															He	
1.01	Hydrogen	4.00	Helium															4.00	
3	Li	4	Be															9	Ne
6.94	Lithium	9.01	Beryllium															19.99	Neon
11	Na	12	Mg															17	Cl
22.99	Sodium	24.31	Magnesium															35.45	Chlorine
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		
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton		
39.10	40.08	44.96	47.87	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80		
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		
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon		
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.07	102.91	106.42	107.87	112.41	114.82	118.71	127.60	127.60	126.90	131.29		
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
Cesium	Barium	Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon		
132.91	137.33	138.91	178.49	180.95	183.84	186.21	190.23	192.22	195.08	196.97	200.59	204.38	207.2	208.98	(209)	(210)	(222)		
87	88	89	104	105	106	107	108	109											
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt											
Francium	Radium	Actinium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Mitrium											
(223)	(226)	(227)	(261)	(262)	(266)	(264)	(269)	(268)											
58	59	60	61	62	63	64	65	66	67	68	69	70	71						
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu						
Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium						
140.12	140.91	144.24	(145)	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04	174.97						
80	81	82	83	84	85	86	87	88	89	100	101	102	103						
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr						
Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium						
232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)						

\* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

### Polyatomic Ions:



## **1b. Type I Compounds (without Polyatomic Ions)**

**EQ:** How do I name and write formulas for Type I Compounds with Polyatomic Ions?

Naming:

<b>Compound</b>	<b>Ions Present</b>	<b>Compound Name</b>
MgBr <sub>2</sub>	X	<b>Magnesium bromide</b>
AgF	X	<b>Silver fluoride</b>
Na <sub>2</sub> S	X	<b>Sodium sulfide</b>
Al <sub>2</sub> O <sub>3</sub>	X	<b>Aluminum oxide</b>
Ba <sub>3</sub> N <sub>2</sub>	X	<b>Barium nitride</b>
<b>CaI<sub>2</sub></b>	<b>Ca<sup>2+</sup><sub>1</sub> I<sup>1-</sup><sub>2</sub> (2+) + (2-) = 0</b>	Calcium Iodide
<b>Rb<sub>2</sub> O</b>	<b>Rb<sup>1+</sup><sub>2</sub> O<sup>2-</sup><sub>1</sub> (2+) + (2-) = 0</b>	Rubidium Oxide
<b>K Cl</b>	<b>K<sup>1+</sup><sub>1</sub> Cl<sup>1-</sup><sub>1</sub> (1+) + (1-) = 0</b>	Potassium Chloride
<b>Al<sub>2</sub> S<sub>3</sub></b>	<b>Al<sup>3+</sup><sub>2</sub> S<sup>2-</sup><sub>3</sub> (6+) + (6-) = 0</b>	Aluminum Sulfide
<b>Li F</b>	<b>Li<sup>1+</sup><sub>1</sub> F<sup>1-</sup><sub>1</sub> (1+) + (1-) = 0</b>	Lithium Fluoride
<b>Na<sub>3</sub> P</b>	<b>Na<sup>1+</sup><sub>3</sub> P<sup>3-</sup><sub>1</sub> (3+) + (3-) = 0</b>	Sodium Phosphide

## 1b. Type I Compounds (w/out Polyatomic Ions) (cont.)

Give the name/formula for each of the following:

- |                          |                          |                                     |                          |
|--------------------------|--------------------------|-------------------------------------|--------------------------|
| 1. $\text{CaF}_2$        | <b>Calcium fluoride</b>  | 7. Beryllium Oxide                  | <b>Be O</b>              |
|                          |                          | $\text{Be}^{2+}_1 \text{O}^{2-}_1$  |                          |
|                          |                          | $(2+) + (2-) = 0$                   |                          |
| 2. $\text{MgI}_2$        | <b>Magnesium iodide</b>  | 8. Strontium Bromide                | <b>Sr Br<sub>2</sub></b> |
|                          |                          | $\text{Sr}^{2+}_1 \text{Br}^{1-}_2$ |                          |
|                          |                          | $(2+) + (2-) = 0$                   |                          |
| 3. $\text{K}_2\text{S}$  | <b>Potassium sulfide</b> | 9. Aluminum Chloride                | <b>Al Cl<sub>3</sub></b> |
|                          |                          | $\text{Al}^{3+}_1 \text{Cl}^{1-}_3$ |                          |
|                          |                          | $(3+) + (3-) = 0$                   |                          |
| 4. $\text{Li}_3\text{P}$ | <b>Lithium phosphide</b> | 10. Sodium Nitride                  | <b>Na<sub>3</sub> N</b>  |
|                          |                          | $\text{Na}^{1+}_3 \text{N}^{3-}_1$  |                          |
|                          |                          | $(3+) + (3-) = 0$                   |                          |
| 5. $\text{BaCl}_2$       | <b>Barium chloride</b>   | 11. Silver Fluoride                 | <b>Ag F</b>              |
|                          |                          | $\text{Ag}^{1+}_1 \text{F}^{1-}_1$  |                          |
|                          |                          | $(1+) + (1-) = 0$                   |                          |
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- |                          |                          |                                     |                                     |
|--------------------------|--------------------------|-------------------------------------|-------------------------------------|
| 1. $\text{Na}_2\text{S}$ | <b>Sodium sulfide</b>    | 7. Barium Iodide                    | <b>Ba I<sub>2</sub></b>             |
|                          |                          | $\text{Ba}^{2+}_1 \text{I}^{2-}_2$  |                                     |
|                          |                          | $(2+) + (2-) = 0$                   |                                     |
| 2. $\text{KBr}$          | <b>Potassium Bromide</b> | 8. Silver Chloride                  | <b>Ag Cl</b>                        |
|                          |                          | $\text{Ag}^{1+}_1 \text{Cl}^{1-}_1$ |                                     |
|                          |                          | $(1+) + (1-) = 0$                   |                                     |
| 3. $\text{Li}_3\text{N}$ | <b>Lithium nitride</b>   | 9. Aluminum Oxide                   | <b>Al<sub>2</sub> O<sub>3</sub></b> |
|                          |                          | $\text{Al}^{3+}_2 \text{O}^{2-}_3$  |                                     |
|                          |                          | $(6+) + (6-) = 0$                   |                                     |
| 4. $\text{CaCl}_2$       | <b>Calcium chloride</b>  | 10. Beryllium Sulfide               | <b>Be S</b>                         |
|                          |                          | $\text{Be}^{2+}_1 \text{S}^{2-}_1$  |                                     |
|                          |                          | $(2+) + (2-) = 0$                   |                                     |
| 5. $\text{MgO}$          | <b>Magnesium oxide</b>   | 11. Lithium Bromide                 | <b>Li Br</b>                        |
|                          |                          | $\text{Li}^{1+}_1 \text{Br}^{1-}_1$ |                                     |
|                          |                          | $(1+) + (1-) = 0$                   |                                     |
| 6. $\text{AlF}_3$        | <b>Aluminum fluoride</b> | 12. Potassium Phosphide             | <b>K<sub>3</sub> P</b>              |
|                          |                          | $\text{K}^{1+}_3 \text{P}^{3-}_1$   |                                     |
|                          |                          | $(3+) + (3-) = 0$                   |                                     |

## 1b. Type I Compounds (with Polyatomic Ions)

EQ: How do I name and write formulas for Type I Compounds?

Naming:

Compound	Ions Present	Compound Name
KClO <sub>3</sub>	X	<b>Potassium chlorate</b>
Ba(NO <sub>2</sub> ) <sub>2</sub>	X	<b>Barium nitrite</b>
Na <sub>2</sub> SO <sub>4</sub>	X	<b>Sodium sulfate</b>
AgC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>	X	<b>Silver acetate</b>
BeSO <sub>3</sub>	X	<b>Beryllium sulfite</b>
<b>Mg (OH)<sub>2</sub></b>	<b>Mg<sup>2+</sup><sub>1</sub> (OH)<sup>1-</sup><sub>2</sub></b> <b>(2+) + (2-) = 0</b>	Magnesium Hydroxide
<b>Li NO<sub>2</sub></b>	<b>Li<sup>1+</sup><sub>1</sub> (NO<sub>2</sub>)<sup>1-</sup><sub>1</sub></b> <b>(1+) + (1-) = 0</b>	Lithium Nitrite
<b>K<sub>2</sub> O<sub>2</sub></b>	<b>K<sup>1+</sup><sub>2</sub> (O<sub>2</sub>)<sup>2-</sup><sub>1</sub></b> <b>(2+) + (2-) = 0</b>	Potassium Peroxide
<b>Ca CO<sub>3</sub></b>	<b>Ca<sup>2+</sup><sub>1</sub> (CO<sub>3</sub>)<sup>2-</sup><sub>1</sub></b> <b>(2+) + (2-) = 0</b>	Calcium Carbonate
<b>Sr<sub>3</sub> (PO<sub>4</sub>)<sub>2</sub></b>	<b>Sr<sup>2+</sup><sub>3</sub> (PO<sub>4</sub>)<sup>3-</sup><sub>2</sub></b> <b>(6+) + (6-) = 0</b>	Strontium Phosphate
<b>NH<sub>4</sub> NO<sub>3</sub></b>	<b>(NH<sub>4</sub>)<sup>1+</sup><sub>1</sub> (NO<sub>3</sub>)<sup>1-</sup><sub>1</sub></b> <b>(1+) + (1-) = 0</b>	<b>Ammonium</b> Nitrate PNII

## 1b. Type I Compounds (cont.)

Give the name/formula for each of the following:

*Mixed Review – With and without Polyatomic Ions*

1. $\text{CaCl}_2$	<b>calcium chloride</b>	7. Lithium Dichromate	<b><math>\text{Li}_2 \text{Cr}_2\text{O}_7</math></b>
			<b><math>\text{Li}^{1+}_2 (\text{Cr}_2\text{O}_7)^{2-}_1</math></b>
2. $\text{Mg}(\text{CN})_2$	<b>magnesium cyanide</b>	8. Beryllium Sulfide	<b><math>\text{Be S}</math></b>
			<b><math>\text{Be}^{2+}_1 \text{S}^{2-}_1</math></b>
3. $\text{KMnO}_4$	<b>potassium permanganate</b>	9. Aluminum Chloride	<b><math>\text{Al Cl}_3</math></b>
			<b><math>\text{Al}^{3+}_1 \text{Cl}^{1-}_3</math></b>
4. $\text{NaHCO}_3$	<b>sodium hydrogen carbonate</b>	10. Calcium Hydroxide	<b><math>\text{Ca} (\text{OH})_2</math></b>
			<b><math>\text{Ca}^{2+}_1 (\text{OH})^{1-}_2</math></b>
5. $\text{Na}_2\text{O}_2$	<b>sodium peroxide</b>	11. Rubidium Acetate	<b><math>\text{Rb C}_2\text{H}_3\text{O}_2</math></b>
			<b><math>\text{Rb}^{1+}_1 (\text{C}_2\text{H}_3\text{O}_2)^{1-}_1</math></b>
6. $\text{Ag}_3\text{P}$	<b>silver phosphide</b>	12. <b>Ammonium</b> Bromide	<b><math>\text{NH}_4 \text{Br}</math></b>
			<b><math>(\text{NH}_4)^{1+}_1 \text{Br}^{1-}_1</math></b>

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1. $\text{Na}_2\text{CO}_3$	<b>sodium carbonate</b>	11. Cesium Oxide	<b><math>\text{Cs}_2 \text{O}</math></b>
			<b><math>\text{Cs}^{1+}_2 \text{O}^{2-}_1</math></b>
2. $\text{K}_2\text{SO}_4$	<b>potassium sulfate</b>	12. Lithium Chlorate	<b><math>\text{Li ClO}_3</math></b>
			<b><math>\text{Li}^{1+}_1 (\text{ClO}_3)^{1-}_1</math></b>
3. $\text{Li}_3\text{N}$	<b>lithium nitride</b>	13. Calcium Phosphate	<b><math>\text{Ca}_3 (\text{PO}_4)_2</math></b>
			<b><math>\text{Ca}^{2+}_3 (\text{PO}_4)^{3-}_2</math></b>
4. $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$	<b>calcium acetate</b>	14. Sodium Nitride	<b><math>\text{Na}_3 \text{N}</math></b>
			<b><math>\text{Na}^{1+}_3 \text{N}^{3-}_1</math></b>
5. $\text{MgBr}_2$	<b>magnesium bromide</b>	15. Sodium Nitrite	<b><math>\text{Na NO}_2</math></b>
			<b><math>\text{Na}^{1+}_1 (\text{NO}_2)^{1-}_1</math></b>
6. $\text{Al}_2\text{O}_3$	<b>aluminum oxide</b>	16. Sodium Nitrate	<b><math>\text{Na NO}_3</math></b>
			<b><math>\text{Na}^{1+}_1 (\text{NO}_3)^{1-}_1</math></b>
7. $\text{Zn}(\text{CN})_2$	<b>zinc cyanide</b>	17. Silver Sulfide	<b><math>\text{Ag}_2 \text{S}</math></b>
			<b><math>\text{Ag}^{1+}_2 \text{S}^{2-}_1</math></b>
8. $\text{NH}_4\text{Cl}$	<b>ammonium chloride</b>	18. Potassium Iodide	<b><math>\text{KI}</math></b>
			<b><math>\text{K}^{1+}_1 \text{I}^{1-}_1</math></b>
9. $\text{RbF}$	<b>rubidium fluoride</b>	19. Barium Hydroxide	<b><math>\text{Ba} (\text{OH})_2</math></b>
			<b><math>\text{Ba}^{2+}_1 (\text{OH})^{1-}_2</math></b>
10. $\text{CsMnO}_4$	<b>cesium permanganate</b>	20. Magnesium Sulfite	<b><math>\text{Mg SO}_3</math></b>
			<b><math>\text{Mg}^{2+}_1 (\text{SO}_3)^{2-}_1</math></b>

## 2. Type II Compounds

EQ: How do I name and write formulas for Type II Compounds?

Naming:

Compound	Ions Present	Compound Name
PtBr <sub>2</sub>	$\text{Pt}^{2+}_1 \text{Br}^{1-}_2$ (2+) + (2-) = 0	platinum (II) bromide
Ni(OH) <sub>2</sub>	$\text{Ni}^{2+}_1 (\text{OH})^{1-}_2$ (2+) + (2-) = 0	nickel (II) hydroxide nickelous hydroxide
CuCO <sub>3</sub>	$\text{Cu}^{2+}_1 (\text{CO}_3)^{2-}_1$ (2+) + (2-) = 0	copper (II) carbonate cupric carbonate
Cr <sub>2</sub> S <sub>3</sub>	$\text{Cr}^{3+}_2 \text{S}^{2-}_3$ (6+) + (6-) = 0	chromium (III) sulfide
Pb(CN) <sub>4</sub>	$\text{Pb}^{4+}_1 (\text{CN})^{1-}_4$ (4+) + (4-) = 0	lead (IV) cyanide plumbic cyanide
Hg (NO <sub>2</sub> ) <sub>2</sub>	$\text{Hg}^{2+}_1 (\text{NO}_2)^{1-}_2$ (2+) + (2-) = 0	Mercury(II) Nitrite
V <sub>2</sub> O <sub>5</sub>	$\text{V}^{5+}_2 \text{O}^{2-}_5$ (10+) + (10-) = 0	Vanadium(V) Oxide
Au NO <sub>3</sub>	$\text{Au}^{1+}_1 (\text{NO}_3)^{1-}_1$ (1+) + (1-) = 0	Gold(I) Nitrate
Co Cl <sub>2</sub>	$\text{Co}^{2+}_1 \text{Cl}^{1-}_2$ (2+) + (2-) = 0	Cobalt(II) Chloride
Sn S <sub>2</sub>	$\text{Sn}^{4+}_1 \text{S}^{2-}_2$ (4+) + (4-) = 0	Tin(IV) Sulfide

## 2. Type II Compounds (cont.)

Give the name/formula for each of the following:

- |  |  |   |   |
|--|--|---|---|
| 1. $\text{SnO}_2$                                | <b>BMII tin(IV)oxide; stannic oxide</b>    | 7. Iron(III) Bromide                      |   |
|  | <b>tin(II) peroxide; stannous peroxide</b> | $\text{Fe}^{3+}_1 \text{Br}^{1-}_3$ :     | <b><math>\text{FeBr}_3</math></b>               |
| 2. $\text{SnO}$                                  | <b>tin(II)oxide;</b>                       | 8. Cadmium(II) Phosphate                  |   |
|  | <b>stannous oxide</b>                      | $\text{Cd}^{2+}_3 (\text{PO}_4)^{3-}_2$ : | <b><math>\text{Cd}_3 (\text{PO}_4)_2</math></b> |
| 3. $\text{CrCO}_3$                               | <b>chromium (III) carbonate</b>            | 9. Mercury(II) Nitrate                    |   |
|  |  | $\text{Hg}^{2+}_1 (\text{NO}_3)^{1-}_2$ : | <b><math>\text{Hg}(\text{NO}_3)_2</math></b>    |
| 4. $\text{Fe}_2(\text{SO}_4)_3$                  | <b>iron (III) sulfate</b>                  | 10. Manganese(IV) Oxide                   |   |
|  | <b>ferrous sulfate</b>                     | $\text{Mn}^{4+}_1 \text{O}^{2-}_2$ :      | <b><math>\text{MnO}_2</math></b>                |
| 5. $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ | <b>lead (II) acetate</b>                   | 11. Gold(III) Chloride                    |   |
|  | <b>plumbous acetate</b>                    | $\text{Au}^{3+}_1 \text{Cl}^{1-}_3$ :     | <b><math>\text{AuCl}_3</math></b>               |
| 6. $\text{NiCl}_2$                               | <b>nickel (II) chloride</b>                | 12. Copper(I) Iodide                      |   |
|  | <b>nickelous chloride</b>                  | $\text{Cu}^{1+}_1 \text{I}^{1-}_1$ :      | <b><math>\text{CuI}</math></b>                  |

- |                                 |                                 |  |   |
|---------------------------------|---------------------------------|--|---|
| 1. $\text{Co}(\text{CN})_3$     | <b>cobalt (III) cyanide</b>     | 11. Titanium(III) Iodide                           |   |
|                                 | <b>cobaltic cyanide</b>         | $\text{Ti}^{3+}_1 \text{I}^{1-}_3$ :               | <b><math>\text{TiI}_3</math></b>              |
| 2. $\text{Mn}(\text{OH})_2$     | <b>manganese (II) hydroxide</b> | 12. Titanium(IV) Iodide                            |   |
|                                 |                                 | $\text{Ti}^{4+}_1 \text{I}^{1-}_4$ :               | <b><math>\text{TiI}_4</math></b>              |
| 3. $\text{CdBr}_2$              | <b>cadmium (II) bromide</b>     | 13. Zirconium(IV) Sulfide                          |   |
|                                 |                                 | $\text{Zr}^{4+}_1 \text{S}^{2-}_2$ :               | <b><math>\text{ZrS}_2</math></b>              |
| 4. $\text{ScCl}_3$              | <b>scandium (III) chloride</b>  | 14. Lead(II) Chromate                              |   |
|                                 |                                 | $\text{Pb}^{2+}_1 (\text{CrO}_4)^{2-}_1$ :         | <b><math>\text{PbCrO}_4</math></b>            |
| 5. $\text{WO}_3$                | <b>tungsten (VI) oxide</b>      | 15. Iron(III) Nitrate                              |   |
|                                 |                                 | $\text{Fe}^{3+}_1 (\text{NO}_3)^{1-}_3$ :          | <b><math>\text{Fe}(\text{NO}_3)_3</math></b>  |
| 6. $\text{Bi}(\text{NO}_3)_3$   | <b>bismuth (III) nitrate</b>    | 16. Iron(III) Nitride                              |   |
|                                 |                                 | $\text{Fe}^{3+}_1 \text{N}^{3-}_1$ :               | <b><math>\text{FeN}</math></b>                |
| 7. $\text{VSO}_4$               | <b>vanadium (II) sulfate</b>    | 17. Tin(II) Oxalate                                |   |
|                                 |                                 | $\text{Sn}^{2+}_1 (\text{C}_2\text{O}_4)^{2-}_1$ : | <b><math>\text{SnC}_2\text{O}_4</math></b>    |
| 8. $\text{CrN}$                 | <b>chromium (III) nitride</b>   | 18. Copper(II) Chlorate                            |   |
|                                 | <b>iron (III) chlorate</b>      | $\text{Cu}^{2+}_1 (\text{ClO}_3)^{1-}_2$ :         | <b><math>\text{Cu}(\text{ClO}_3)_2</math></b> |
| 9. $\text{Fe}(\text{ClO}_3)_3$  | <b>ferric chlorate</b>          | 19. Gold(I) Cyanide                                |   |
|                                 | <b>cupric permanganate</b>      | $\text{Au}^{1+}_1 (\text{CN})^{1-}_1$ :            | <b><math>\text{AuCN}</math></b>               |
| 10. $\text{Cu}(\text{MnO}_4)_2$ | <b>copper (II) permanganate</b> | 20. Nickel(II) Phosphide                           |   |
|                                 |                                 | $\text{Ni}^{2+}_3 \text{P}^{3-}_2$ :               | <b><math>\text{Ni}_3\text{P}_2</math></b>     |

## 2. Type II Compounds (cont.)

### **\*Older System of Naming\***

**Refer to the Type II Cation IUPAC and Old Name Handout**

Examples:

<b>Sn(NO<sub>3</sub>)<sub>2</sub>:</b>  <b>tin(II) nitrate</b> <b>stannous nitrate</b>	<b>Au(NO<sub>3</sub>)<sub>3</sub>:</b>  <b>gold(III) nitrate</b> <b>auric nitrate</b>
<b>Pb(NO<sub>3</sub>)<sub>4</sub>:</b>  <b>lead(IV) nitrate</b> <b>plumbic nitrate</b>	<b>Sb(NO<sub>3</sub>)<sub>5</sub>:</b>  <b>antimony(V) nitrate</b> <b>stibic nitrate</b>

Name the following compounds using the OLDER system of naming.

- |                                   |                          |                                      |                          |
|-----------------------------------|--------------------------|--------------------------------------|--------------------------|
| 1. CuCl                           | <b>cuprous chloride</b>  | 5. PbSO <sub>4</sub>                 | <b>plumbous sulfate</b>  |
| 2. CuCl <sub>2</sub>              | <b>cupric chloride</b>   | 6. Pb(SO <sub>4</sub> ) <sub>2</sub> | <b>plumbic sulfate</b>   |
| 3. Fe <sub>2</sub> O <sub>3</sub> | <b>ferric oxide</b>      | 7. SnCl <sub>2</sub>                 | <b>stannous chloride</b> |
| 4. FeO                            | <b>ferrous oxide</b>     | 8. SnCl <sub>4</sub>                 | <b>stannic chloride</b>  |
| 5. CoSO <sub>3</sub>              | <b>cobaltous sulfite</b> | 10. NiH <sub>2</sub>                 | <b>nickelous hydride</b> |

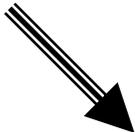
### **\*Type I vs. Type II\***

- |  |  |  |  |
|--|--|--|--|
| 1. (NH <sub>4</sub> ) <sub>3</sub> PO <sub>3</sub> | <b>Type I</b><br><b>ammonium phosphite</b>                               | 4. K <sub>3</sub> P                              | <b>Type I</b><br><b>potassium phosphide</b>          |
| 2. ZnO <sub>2</sub>                                | <b>Type I</b><br><b>zinc peroxide</b>                                    | 5. Sc(ClO) <sub>3</sub>                          | <b>Type II</b><br><b>scandium (III) hypochlorite</b> |
| 3. CoSO <sub>4</sub>                               | <b>Type II</b><br><b>cobalt (II) sulfate</b><br><b>cobaltous sulfate</b> | 6. Cs <sub>2</sub> C <sub>2</sub> O <sub>4</sub> | <b>Type I</b><br><b>cesium oxalate</b>               |

# Compare / Contrast Type I and Type II Compounds?

**Type 1**

**Type II**



**How Alike?**



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**How Different?**



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**With Regard To**

Metal's PT Location

Oxidation States

IUPAC Naming

Old Names

Determining Cation Charges

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## 2. Type II Compounds (cont.)

### \*Type I & Type II Table\*

	$\text{Na}^+$	$\text{Cu}^{2+}$	$\text{Al}^{3+}$	$\text{Pb}^{4+}$
$\text{Cl}^-$	<b>Na Cl</b>	<b>Cu Cl<sub>2</sub></b>	<b>Al Cl<sub>3</sub></b>	<b>Pb Cl<sub>4</sub></b>
$\text{SO}_4^{2-}$	<b>Na<sub>2</sub> SO<sub>4</sub></b>	<b>Cu SO<sub>4</sub></b>	<b>Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub></b>	<b>Pb (SO<sub>4</sub>)<sub>2</sub></b>
$\text{N}^{3-}$	<b>Na<sub>3</sub> N</b>	<b>Cu<sub>3</sub> N<sub>2</sub></b>	<b>Al N</b>	<b>Pb<sub>3</sub> N<sub>4</sub></b>

Give the name/formula for each of the following:

- CaCO<sub>3</sub>    **Calcium Carbonate**      5. Beryllium Fluoride    **Be F<sub>2</sub>**
- HgO      **Mercury (II) Oxide**      6. Lead(II) Chloride    **Pb Cl<sub>2</sub>**  
              **Mercuric Oxide**
- Cr(CN)<sub>3</sub>    **Chromium(III)Cyanide**    7. Magnesium Sulfide    **Mg S**
- LiClO<sub>3</sub>    **Lithium Chlorate**      8. Tin(IV) Oxalate      **Sn(C<sub>2</sub>O<sub>4</sub>)<sub>2</sub>**

Name the following using the OLDER system of naming.

$\text{Cu}(\text{NO}_3)_2$   
**Cupric Nitrate**

$\text{SnCl}_2$   
**Stannous Chloride**

$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$   
**Plumbous Acetate**

Complete the following table with formula and name:

	$\text{Au}^+$	$\text{Mg}^{2+}$	$\text{Pb}^{2+}$	$\text{Al}^{3+}$
$\text{O}^{2-}$	<b>Au<sub>2</sub> O</b> <b>Gold (I) Oxide</b> <b>Aurous Oxide</b>	<b>Mg O</b> <b>Magnesium Oxide</b>	<b>Pb O</b> <b>Lead (II) Oxide</b> <b>Plumbous Oxide</b>	<b>Al<sub>2</sub> O<sub>3</sub></b> <b>Aluminum Oxide</b>



### 3. Type III Compounds (cont.)

Give the name/formula for each of the following. (Identify the type first.)

- |                                      |                               |                         |   |
|--------------------------------------|-------------------------------|-------------------------|---|
| 1. NaCl                              | <b>sodium chloride</b>        | 6. Carbon Tetraiodide   | <b>Cl<sub>4</sub></b>                             |
| <b>Type I</b>                        |                               | <b>Type III</b>         |   |
| 2. SF <sub>6</sub>                   | <b>sulfur hexafluoride</b>    | 7. Copper(II) Hydroxide | <b>Cu(OH)<sub>2</sub></b>                         |
| <b>Type III</b>                      |                               | <b>Type II</b>          |   |
| 3. Cr(NO <sub>3</sub> ) <sub>3</sub> | <b>chromium (III) nitrate</b> | 8. Aluminum Sulfate     | <b>Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub></b> |
| <b>Type II</b>                       |                               | <b>Type I</b>           |   |
| 4. N <sub>2</sub> O <sub>3</sub>     | <b>dinitrogen trioxide</b>    | 9. Gold(III) Chloride   | <b>AuCl<sub>3</sub></b>                           |
| <b>Type III</b>                      |                               | <b>Type II</b>          |   |
| 5. K <sub>2</sub> SO <sub>3</sub>    | <b>potassium sulfite</b>      | 10. Dinitrogen Monoxide | <b>N<sub>2</sub>O</b>                             |
| <b>Type I</b>                        |                               | <b>Type III</b>         |   |

Compound	Compound Name	Type I, II, or III?
LiBr	<b>lithium bromide</b>	<b>Type I</b>
FeCl <sub>3</sub>	<b>iron (III) chloride</b> <b>ferric chloride</b>	<b>Type II</b>
PH <sub>3</sub>	<b>phosphorus trihydride</b>	<b>Type III</b>
<b>Co<sub>2</sub>O<sub>3</sub></b>	Cobalt(III) Oxide	<b>Type II</b>
<b>Ag<sub>2</sub>SO<sub>4</sub></b>	Silver Sulfate	<b>Type I</b>
<b>As<sub>2</sub>O<sub>5</sub></b>	Diarsenic Pentoxide	<b>Type III</b>
Sn(NO <sub>3</sub> ) <sub>4</sub>	<b>tin (IV) nitrate</b> <b>stannic nitrate</b>	<b>Type II</b>
N <sub>2</sub> O	<b>dinitrogen monoxide</b>	<b>Type III</b>
Na <sub>2</sub> O <sub>2</sub>	<b>sodium peroxide</b>	<b>Type I</b>
CuCO <sub>3</sub>	<b>copper (II) carbonate</b> <b>cupric carbonate</b>	<b>Type II</b>
ClBr	<b>chlorine monobromide</b>	<b>Type III</b>
<b>SiCl<sub>4</sub></b>	Silicon Tetrachloride	<b>Type III</b>
<b>CuOH</b>	Copper(I) Hydroxide	<b>Type II</b>
<b>Ba(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub></b>	Barium Acetate	<b>Type I</b>

## 4. Acids

EQ: How do I name and write formulas for Acids?

### Naming Acids:

<u>Acids WITHOUT Oxygen</u>	<u>Acids WITH Oxygen</u>

Formula	Ions Present	Anion Name	Acid Name
HCl hydracid	$\text{H}^{1+} \text{Cl}^{1-}$ $(1+) + (1-) = 0$	chloride	hydrochloric acid
H <sub>2</sub> SO <sub>3</sub> oxyacid	$\text{H}^{1+} (\text{SO}_3)^{2-}$ $(2+) + (2-) = 0$	sulfite	sulfurous acid
HBr hydracid	$\text{H}^{1+} \text{Br}^{1-}$ $(1+) + (1-) = 0$	bromide	hydrobromic acid
H <sub>3</sub> PO <sub>4</sub> oxyacid	$\text{H}^{1+} (\text{PO}_4)^{3-}$ $(3+) + (3-) = 0$	phosphate	phosphoric acid
HF hydracid	$\text{H}^{1+} \text{F}^{1-}$ $(1+) + (1-) = 0$	fluoride	Hydrofluoric Acid
HCN hydracid	$\text{H}^{1+} (\text{CN})^{1-}$ $(1+) + (1-) = 0$	cyanide	Hydrocyanic Acid
H <sub>2</sub> SO <sub>4</sub> oxyacid	$\text{H}^{1+} (\text{SO}_4)^{2-}$ $(2+) + (2-) = 0$	sulfate	Sulfuric Acid
HNO <sub>2</sub> oxyacid	$\text{H}^{1+} (\text{NO}_2)^{1-}$ $(1+) + (1-) = 0$	nitrite	Nitrous Acid

## 4. Acids

A. Give the name/formula for each of the following acids:

- |                    |                          |                      |   |
|--------------------|--------------------------|----------------------|---|
| 1. $\text{HNO}_3$  | <b>nitric acid</b>       | 5. Hydrobromic Acid  | <b>HBr</b>  |
| 2. HI              | <b>hydroiodic acid</b>   | 6. Acetic Acid       | <b><math>\text{HC}_2\text{H}_3\text{O}_2</math></b> |
| 3. $\text{HClO}_3$ | <b>chloric acid</b>      | 7. Phosphoric Acid   | <b><math>\text{H}_3\text{PO}_4</math></b>           |
| 4. HCl             | <b>hydrochloric acid</b> | 8. Hydrofluoric Acid | <b>HF</b>   |

B. Give the name for each of the following compounds:

- |                           |   |   |  |
|---------------------------|---|---|--|
| 1. $\text{BrF}_5$         | <b>bromine pentafluoride</b>                        | 6. $\text{Zn}_3(\text{PO}_4)_2$         | <b>zinc phosphate</b>                                |
| 2. $\text{FeBr}_3$        | <b>iron (III) bromide</b><br><b>ferric bromide</b>  | 7. $\text{SnCl}_2$                      | <b>tin (II) chloride</b><br><b>stannous chloride</b> |
| 3. $\text{MgI}_2$         | <b>magnesium iodide</b>                             | 8. $\text{Na}_3\text{N}$                | <b>sodium nitride</b>                                |
| 4. $\text{PbSO}_4$        | <b>lead (II) sulfate</b><br><b>plumbous sulfate</b> | 9. <i>Acid:</i> $\text{H}_2\text{CO}_3$ | <b>carbonic acid</b>                                 |
| 5. $\text{B}_2\text{O}_3$ | <b>diboron trioxide</b>                             | 10. <i>Acid:</i> HCN                    | <b>hydrocyanic acid</b>                              |

C. Give the formula for each of the following compounds:

- |                         |  |                             |   |
|-------------------------|--|-----------------------------|---|
| 1. Cobalt(III) Chloride | <b><math>\text{CoCl}_3</math></b>          | 6. Dinitrogen Trioxide      | <b><math>\text{N}_2\text{O}_3</math></b>        |
| 2. Lead(IV) Oxide       | <b><math>\text{PbO}_2</math></b>           | 7. <b>Ammonium</b> Chromate | <b><math>(\text{NH}_4)_2\text{CrO}_4</math></b> |
| 3. Sodium Carbonate     | <b><math>\text{Na}_2\text{CO}_3</math></b> | 8. Hydrofluoric Acid        | <b>HF</b>                                       |
| 4. Carbon Tetrachloride | <b><math>\text{CCl}_4</math></b>           | 9. Sulfurous Acid           | <b><math>\text{H}_2\text{SO}_3</math></b>       |
| 5. Copper(II) Cyanide   | <b><math>\text{Cu}(\text{CN})_2</math></b> | 10. Sulfuric Acid           | <b><math>\text{H}_2\text{SO}_4</math></b>       |

D. Name the following using the OLDER system of naming:

