ELEMENTS AND **COMPOUNDS**

CHEMICAL NAMES AND FORMULAS

LEARNING TARGET

 Identify, name and write formulas for ionic (binary, multivalent, polyatomic, and hydrates) and molecular compounds, and acids using the IUPAC and classical systems.

ATOMS AND IONS

- <u>Atoms</u> are electrically neutral.
 - -Because there is the same number of protons (+) and electrons (-).
- <u>lons</u> are atoms, or groups of atoms, with a charge (positive or negative)
 - -They have *different* numbers of protons and electrons.
- Only *electrons* can move, and **ions** are made by gaining or losing electrons.

AN ANION IS...

- A negative ion.
- Has gained electrons.
- <u>Nonmetals can gain</u> electrons.
- Charge is written as a superscript on the right.
 - F¹- Has gained one electron (-ide is new ending = fluoride)
 O²- Gained two electrons (oxide)

A Cation is...

- A positive ion.
- Formed by losing electrons.
- More protons than electrons.
- Metals can lose electrons
 - K^{1+} Has lost one electron (no name change for positive ions) Ca^{2+} Has lost two electrons

Group 1A: Lose 1 electron to form 1+ ions

H¹+ Li¹+ Na¹+ K¹+ Rb¹+

1 H 1.00794		_															He 4.002602
Li	4 Be											B	ć	Ň	Ô	9 F	Ne
6.941	9.012182											10.811	12.0107	14.00674	15.9994	18.9984032	20.1797
11	12											13	14	в D	16	17	18
Na 22.989770	Mg 24.3050											Al 26.981538	Si 28.0855	P 30.973761	S 32.866	CI 35.4527	Ar 39.948
19	29	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Са	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39,0983	40.078	44.955910	47.867	50.9415		54.938049	55.845	58.933200	58.6934	63.546	65.39	69.723	72.61	74.92160	78.96	79.904	83.80
Rb	38 Sr	39 V	⁴⁰ Zr	⁴¹ Nb	Mo	43 Tc	44 D 11	⁴⁵ Rh	46 D.4	47	48	49 In	50 Sm	Sb	Te	53 T	Xe 54
KD 85.4678	51 87.62	1 88.90585	Z.1 91.224	1ND 92.90638	1VIO 95.94	(98)	Ru 101.07	INTI 102.90550	Pd 106.42	Ag 107.8682	Cd 112.411	In 114.818	Sn 118.710	121.760	127.60	1 126.90447	131.29
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	T1	Pb	Bi	Po	At	Rn
132.90545	137.327	138.9055	178.49	180.9479	183.84	186.207	190.23	192.217	195.078	196.96655	200.59	204.3833	207.2	208.98038	(209)	(210)	(222)
87	88	89	104	105	106	107	108	109	110	111	112		114		116		
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt		(272)	(227)		(289)		(200)		
(223)	(226)	(227)	(261)	(262)	(263)	(262)	(265)	(266)	(269)	(272)	(277)		(287)		(289)		

Group 2A: Loses 2 electrons to form 2+ ions

1 Н He 4.002602 1.007943 4 10 F Li Be В С Ν Ο Ne 9.012182 10.811 12.0107 14.00674 15.9994 8.998403 20.1797 6.941 11 12 13 14 15 16 17 18 Na Mg Р A1 Si S Cl Ar 22.989770 24.3050 6.98153 28.0855 30.97376 32.066 35,4527 39.948 19 20 21 22 2324 25 26 27 Ni 29 30 31 32 33 34 35 36 V Са Sc Ti Cr Mn Fe Co Cu Br Kr K Zn Ga Ge As Se 44.955910 47.867 50.9415 51.9961 58.933200 58.6934 63.546 19.0981 40.078 54.938049 55.845 65.39 69.72372.6174.92160 78.96 79.904 83.80 37 40 52 38 39 41 42 43 44 45 46 47 48 49 50 51 53 54 Υ Ag 107.8682 Ι Xe Rb Sr Zr Nb Tc Pd SbTe Mo Ru Rh Cd In Sn 85,4678 88.90585 92.90638 106.42 112.411 114.818 118.710 121.760127.60 131.29 87.62 91.224 95.94 (98) 101.07126.9044 102.90550 56 84 72 73 74 76 78 81 82 83 85 86 Pt Ba Ηf Та W Re Os Hg 200.59 T1 Pb Bi Po Rn Cs La Ir Au At 132.90545 137.327 138.9055 178.49 180.9479 183.84 186.207 190.23 192.217 195.078 196.9665 204.3833 207.2 208.98038 (209)(210)(222) 87 88 89 104 105 106 107 108 112 109 110 111 114 116 Sg (263) Fr Ra Ac Rf Db Bh Hs Mt (289) (287) (277)(223)(226)(227)(261)(262)(262)(265)(266)(269)(272)(289)

Be²⁺ Mo²⁺ Ca²⁺ Sr²⁺ Ba²⁺

3+ A3+ Ga3+

<u>Group 3A</u>: Loses 3 electrons to form 3+ ions

1 H 1.00794												\checkmark					He 4.002602
3 Li 6.941	4 Be 9.012182											B 10.811	C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.866	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga @.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 197.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	(272)	112 (277)		114 (289) (287)		116 (289)		

Neither! Group 4A elements rarely form ions (they tend to share)

<u>Group 4A</u>: Do they lose 4 electrons or gain 4 electrons?

1 H 1.00794																	4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	Č 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	²² Ti 47.867	23 V 50.9415	24 Cr 51.9961	²⁵ Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga @.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 197.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		(289)		

- N³⁻ Nitride
- ⁹³⁻ Phosphide

<u>Group 5A</u>: Gains 3 electrons to form 3- ions

As³⁻ Arsenide

1 H 1.00794																	He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.866	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	29 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	²⁵ Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 T1 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		

- O²⁻ Oxide
- S²⁻ Sulfide

e²⁻ Selenide

<u>Group 6A</u>: Gains 2 electrons to form 2- ions

1 H 1.00794		_												Ż			He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 0 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.866	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	28 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	88 Hg 208.59	81 T1 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		

F1-FluorideBr1-BromideGroup 7A:GainsCl1-ChlorideI1-Iodide1electron to formCl1-ChlorideI1-Iodide1-ions

1 H 1.00794																	He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	F 18.998403	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.866	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	29 Ca 40.078	21 Sc 44.955910	Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 197.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		

<u>Group 8A</u>: Stable noble gases <u>do not</u> form ions!

1 H 1.00794																	2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.998403	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	Ti 47.867	23 V 50.9415	24 Cr 51.9961	²⁵ Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	²⁹ Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)		45 Rh 102.90550		47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 T1 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	(272)	(277)		114 (289) (287)		116 (289)		

<u>Group B elements</u>: Many transition elements have more than one possible positive ion.

Note the use of **Roman** numerals to show charges

Iron (II) = Fe^{2+} Iron (III) = Fe^{3+}

1 H 1.00794		_															He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	²² Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 M11 54.9380.'9	26 Fe 55.845	27 CO 4.933200	28 Ni 58.6934	Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)		45 Rh 102.90550		47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 CS 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 T1 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	(272)	(277)		114 (289) (287)		116 (289)		

NAMING CATIONS

- <u>Two methods</u> can clarify when more than one charge is possible:
 - Stock system uses roman
 numerals in parenthesis to indicate
 the numerical value
 - 2) <u>Classical method</u> uses root word with *suffixes* (-ous, -ic)
 - Does not give true value

NAMING CATIONS

- We will use the **<u>Stock system</u>**.
- Cation if the charge is always the same (like in the Group A metals) just write the name of the metal.
- Transition metals can have more than one type of charge.
 - -Indicate their charge as a **roman numeral** in parenthesis after the name of the metal (Table 9.2, p.255)

Some of the <u>post-transition</u> elements also have more than one possible ionic charge. Tin (II) = Sn^{2+} Lead (II) = Pb^{2+} Tin (IV) = Sn^{4+} Lead (IV) = Pb^{4+}

1 H 1.00794																	He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 6.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	²² Ti 47.867	23 V 50.9415	24 Cr 51.9961	²⁵ Mn 54.938049	26 Fe 55.845	CO 58.933200	28 Ni 58.6934	²⁹ Cu _{63.546}	30 Zn 65.39	31 03 69.72	32 Ge (2.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)		45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.813	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		

<u>Group B elements</u>:Some transition elements have <u>only one</u> possible ionic charge, such as these three:

2+ 2+ 1+ Н He 1.00794 4.002602 F Li Be В С Ν Ο Ne 6.941 9.012182 10.811 12.0107 14.00674 15.9994 18.998403 20.1797 11 12 13 14 18 15 16 17 Si Р Na Mg Al S C1Ar 2.98977 24.3050 6.981538 28.0855 30.97376 32.066 35.4527 39.948 19 20 21 23 24 25 26 31 32 33 34 35 36 22 27 Zn V Κ Sc Ti Cr Mn Fe Co Ni Cu Ga As Br Kr Ca Ge Se 58.9415 40.078 44.955910 47.867 51.9961 58.93320 58.6934 Jacon. 69.723 72.6174.92160 39.0927 55.845 78.96 79.904 83.80 54.93804 49 52 54 40 42 43 44 45 46 47 50 51 53 38 39 41 Sr Υ Pd Cd SbRh Ag 107.8682 Rb Zr Nb Mo Tc Ru In Sn Te Ι Xe 85,4678 87.62 88.90585 91.224 92.90638 95.94 101.07 106.42 112.411 114.818 118.710 121.760127.60 131.29 (98)02.9055 26.90447 57 74 56 72 73 75 76 82 83 84 85 86 Hg 200.59 Cs Hf W Re Pt Tl Pb Bi Po Ba La Ta Os Ir Au At Rn 204.3833 (210)132,9054 137.327 138.9055 178.49 180.9479 183.84 186.207 190.23 192.217 195.078 196.96655 207.2 208.98038 (209)(222) 87 88 89 104 105 106 107 108 109 112 110 111 114 116 Sg Rf Db Bh Fr Ra Ac Hs Mt (289) (287) (223)(226)(227)(261)(262)(265)(277)(262)(266)(269)(272)(289)

EXCEPTIONS:

- Some of the transition metals have <u>only one</u> ionic charge:
 - -**Do not** need to use roman numerals for these:
 - -<u>Silver</u> is always I+ (Ag^{I+})
 - -<u>Cadmium</u> and <u>Zinc</u> are **always** 2+ (**Cd**²⁺ and **Zn**²⁺)

PRACTICE BY NAMING THESE:

- •Na^{I+}
- Ca²⁺
- **A**|³⁺
- **Fe**³⁺
- **Fe**²⁺
- **Pb**²⁺
- Li⁺⁺

WRITE SYMBOLS FOR THESE:

- Potassium ion
- Magnesium ion
- •Copper (II) ion
- •Chromium (VI) ion
- Barium ion
- •Mercury (II) ion

NAMING ANIONS

- •Anions are <u>always</u> the same charge
- •Change the monatomic element ending to – ide
- •**F**^{I-} a Fluor<u>ine</u> atom will become a Fluor<u>ide</u> ion.

PRACTICE BY NAMING THESE:

- •CI^{|-}
- N³⁻
- •Br^{I-}
- O²⁻
- •Ga³⁺

WRITE SYMBOLS FOR THESE:

- •Sulfide ion
- lodide ion
- Phosphide ion
- •Strontium ion

POLYATOMIC IONS ARE...

- Groups of atoms that stay together and have an overall charge, and one name.
- Usually end in -ate or -ite
- Acet<u>ate</u>: **C**₂**H**₃**O**₂^I-
- Nitr<u>ate</u>: **NO**₃^I-
- Nitr<u>ite</u>: NO₂^I-
- Permangan<u>ate</u>: MnO₄^I-
- Hydroxide: **OH**^{I-} and Cyanide: **CN**^{I-}

Table 9.3 on page 257

- Sulf<u>ate</u>: **SO**₄²⁻
- Sulf<u>ite</u>: **SO**₃²⁻
- Carbon<u>ate</u>: **CO**₃²⁻
- Chrom<u>ate</u>: **CrO₄²⁻**
- Dichrom<u>ate</u>: **Cr₂O₇²⁻**

- Phosph<u>ate</u>: **PO₄³⁻**
- Phosph<u>ite</u>: **PO₃³⁻**
- Ammonium: **NH**⁴ (One of the few positive polyatomic ions)

If the polyatomic ion begins with H, then combine the word hydrogen with the other polyatomic ion present: $H^{1+} + CO_3^{2-} \rightarrow HCO_3^{1-}$ hydrogen + carbonate \rightarrow hydrogen carbonate ion

REVIEW QUESTIONS

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 - -#s 3 9.
 - -Guided Reading Sheet

NAMING AND WRITING FORMULAS FOR IONIC COMPOUNDS

• <u>OBJECTIVES:</u>

-<u>Apply the rules</u> for naming and writing formulas for <u>binary</u> <u>ionic compounds.</u>

NAMING AND WRITING Formulas for ionic Compounds

- <u>OBJECTIVES:</u>
 - -<u>Apply the rules</u> for naming and writing formulas for compounds containing polyatomic ions.

<u>WRITING IONIC COMPOUND</u> <u>Formulas</u>

Example: Barium nitrate (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.

3. Balance charges , if necessary, using subscripts. Use parentheses if you need more than one of a polyatomic ion. Use the *criss-cross* method to balance subscripts.

Now balanced. Not balanced! = Ba(NO₃)₂

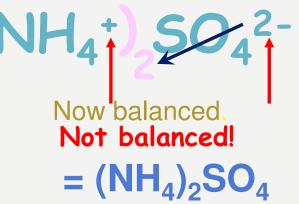
WRITING IONIC COMPOUND Formulas

Example: Ammonium sulfate (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.

3. Balance charges , if necessary, using subscripts. Use parentheses if you need more than one of a <u>polyatomic ion</u>. Use the *criss-cross* method to balance the subscripts.



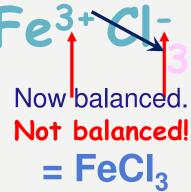
<u>WRITING IONIC COMPOUND</u> <u>Formulas</u>

Example: Iron (III) chloride (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.

3. Balance charges , if necessary, using subscripts. Use parentheses if you need more than one of a <u>polyatomic ion</u>. Use the *criss-cross* method to balance the subscripts.



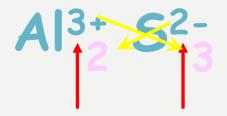
<u>WRITING IONIC COMPOUND</u> <u>Formulas</u>

Example: Aluminum sulfide (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.

3. Balance charges , if necessary, using subscripts. Use parentheses if you need more than one of a <u>polyatomic ion</u>. Use the *criss-cross* method to balance the subscripts.



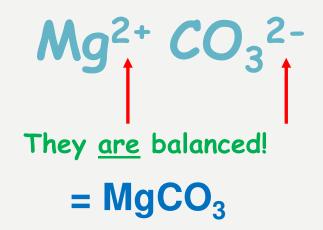
Not balanced! Now balanced. $= Al_2S_3$

WRITING IONIC COMPOUND Formulas

Example: Magnesium carbonate (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.



<u>WRITING IONIC COMPOUND</u> <u>Formulas</u>

Example: Zinc hydroxide (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.

3. Balance charges , if necessary, using subscripts. Use parentheses if you need more than one of a <u>polyatomic ion</u>. Use the *criss-cross* method to balance the subscripts.



Not balanced!

= **Zn(OH)**₂

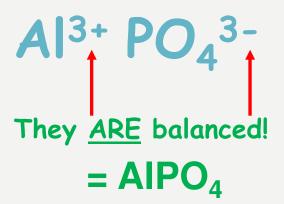
Now balanced.

WRITING IONIC COMPOUND Formulas

Example: Aluminum phosphate (note the 2 word name)

1. Write the formulas for the cation and anion, including <u>CHARGES</u>!

2. Check to see if charges are balanced.



NAMING IONIC COMPOUNDS

- I. Name the cation first, then anion
- 2. Monatomic cation = name of the element

 $Ca^{2+} = calcium$ ion

• 3. Monatomic anion = root + -ide CI^- = chloride $CaCl_2$ = calcium chloride

(Metals with multiple oxidation states)

- some metals can form more than one charge (usually the transition metals)
- use a <u>Roman numeral</u> in their name:

PbCl₂ – use the <u>anion</u> to find the charge on the cation (chloride is always 1-)

 Pb^{2+} is the lead (II) cation PbCl₂ = lead (II) chloride

THINGS TO LOOK FOR:

- I) If cations have (), the number in parenthesis is their charge.
- If anions end in -ide they are probably off the periodic table (Monoatomic)
- 3) If anion ends in -ate or -ite, then it is polyatomic

PRACTICE BY WRITING THE FORMULA OR NAME AS REQUIRED...

- Iron (II) Phosphate
- Stannous Fluoride
- Potassium Sulfide
- Ammonium Chromate
- MgSO₄
- FeCl₃

PRACTICE

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 - ■#s |7 |9.
 - Chapter 9.2 practice problems from worksheet.