

# Chapter 2 Part 3

Dr. Turner



# Binary Nonmetals

- First, name the first element with the appropriate prefix
  - ▣ A prefix **IS NOT** needed if there is only one atom of the first element
- Second, name the second element with the appropriate prefix and change it to end in *-ide*
  - ▣ A prefix **IS** needed if there is only one atom of the second element
- Sometimes compounds are referred to with common names instead of the binary nonmetal nomenclature
  - ▣ Ex.  $\text{H}_2\text{O}$  is water and  $\text{NH}_3$  is ammonia

Number of Atoms	Prefix
1	mon(o)-
2	di-
3	tri-
4	tetr(a)-
5	pent(a)-
6	hex(a)-
7	hept(a)-
8	oct(a)-
9	non(a)-
10	dec(a)-



# Naming Binary Nonmetals

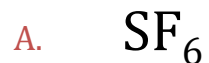
Name the compound  $\text{SO}_2$ .

- A. sulfur oxide
- B. monosulfur oxide
- C. monosulfur dioxide
- D. sulfur dioxide



# Naming Binary Nonmetals

Name the following binary nonmetals





Category	Percentage
Red	10%
Blue	90%

\* Lanthanide series

# Actinide  
series

89 <b>Ac</b> (227)	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> (237)	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (262)
--------------------------	---------------------------	---------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---------------------------	---------------------------	---------------------------	---------------------------



# The other elements have variable charges

1																	18	
1 H 1.008	2																2 He 4.0026	
3 Li 6.94	4 Be 9.0122											5 B 10.81	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.085	15 P 30.974	16 S 32.06	17 Cl 35.45	18 Ar 39.948	
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.630	33 As 74.922	34 Se 78.97	35 Br 79.904	36 Kr 83.798	
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.95	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29	
55 Cs 132.91	56 Ba 137.33	57-71 *	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra (226)	89-103 #	104 Rf (265)	105 Db (268)	106 Sg (271)	107 Bh (270)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (289)	116 Lv (293)	117 Ts (294)	118 Og (294)	

\* Lanthanide series

57 <b>La</b> 138.91	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	66 <b>Dy</b> 162.50	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.05	71 <b>Lu</b> 174.97
---------------------------	---------------------------	---------------------------	---------------------------	--------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------	---------------------------

# Actinide series

89 <b>Ac</b> (227)	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> (237)	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (262)
--------------------------	---------------------------	---------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---------------------------	---------------------------	---------------------------	---------------------------



# Polyatomic ions to memorize

Name of Ion	Symbol
Ammonium	$\text{NH}_4^+$
Acetate	$\text{C}_2\text{H}_3\text{O}_2^-$ or $\text{CH}_3\text{COO}^-$
Cyanide	$\text{CN}^-$
Hydroxide	$\text{OH}^-$
Chlorate	$\text{ClO}_3^-$
Perchlorate	$\text{ClO}_4^-$
Nitrite	$\text{NO}_2^-$
Nitrate	$\text{NO}_3^-$
Sulfite	$\text{SO}_3^{2-}$
Sulfate	$\text{SO}_4^{2-}$
Carbonate	$\text{CO}_3^{2-}$
Phosphite	$\text{PO}_3^{3-}$
Phosphate	$\text{PO}_4^{3-}$

- You need to know the name, symbol, and charge



# Naming ions

- For polyatomic ions, just give the name of the polyatomic ion with “ion” at the end
  - ▣ Ex.  $\text{NH}_4^+$  is ammonium ion
- For metals with fixed charges, give the name of the metal with “ion” at the end
  - ▣ Ex.  $\text{Mg}^{2+}$  is magnesium ion



# Naming ions

- For metals without a fixed oxidation number
  - ▣ Give the name of the metal
  - ▣ Indicate the charge in parenthesis **without** a space between the symbol and parenthesis with “ion” at the end
    - Ex. tin(II) ion is correct; tin (II) is not
- For nonmetal ions, adjust the ending of elements to end in *-ide* with “ion” at the end
  - ▣ Ex.  $\text{N}^{3-}$  is nitride ion



# Naming ions

Name the following ions





# Forming Neutral Ionic Compounds

- All ionic compounds are electrically neutral, so the total positive charge of the cations must balance the total negative charge of the anions in the formula

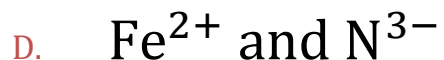
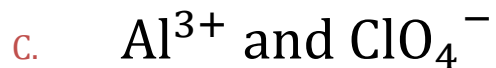
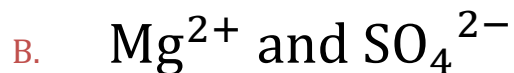
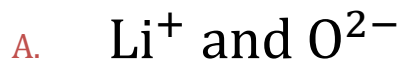
$$\text{Total positive charge} = \text{Total negative charge}$$

For example, a compound of  $\text{Sr}^{2+}$  and  $\text{CN}^-$  will have the formula  $\text{Sr}(\text{CN})_2$



# Forming Neutral Ionic Compounds

Form neutral compounds from the following pairs.





# Forming Neutral Ionic Compounds

What is the formula for a compound made from  $\text{Na}^+$  and  $\text{O}^{2-}$ ?

- A.  $\text{NaO}$
- B.  $\text{NaO}_2$
- C.  $\text{Na}_2\text{O}$
- D.  $\text{Na}_2\text{O}_2$
- E.  $\text{NaO}_3$



# Naming ionic compounds

- First name the cation
  - ▣ If the cation metal comes from groups 1, 2, or 3, it has a fixed charge, so the charge does not need to be written
  - ▣ If the cation metal without a fixed charge, include the charge as a roman numeral
  - ▣ no space is needed between the symbol and parenthesis
    - Ex. iron(II) is correct; iron (II) is not
- Then name the anion
  - ▣ Adjust the ending of elements to end in *-ide*
  - ▣ For polyatomic anions, simply put the name of the polyatomic ion

Number	Roman Numeral
1	I
2	II
3	III
4	IV
5	V
6	VI
7	VII
8	VIII
9	IX
10	X



# Naming ionic compounds

---

Name the compound  $\text{Mn}(\text{CO}_3)_2$ .



# Naming ionic compounds

Name the following compounds





# Ionic Compounds

What is the name of  $\text{Mg}_3(\text{PO}_4)_2$ ?

- A. magnesium phosphorus oxide
- B. trimagnesium diphosphate
- C. magnesium phosphate
- D. magnesium phosphide



# Naming Hydrates

- Some ionic compounds also have waters of hydration that get trapped in the lattice structure when forming the ionic compound.
- These compounds are called hydrates
- To name hydrates, first, name the ionic compound, and then combine a prefix that identifies the number of water molecules with the word hydrate
  - ▣ Ex.  $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$  is copper(II) sulfate pentahydrate

Number of Atoms	Prefix
1	mon(o)-
2	di-
3	tri-
4	tetr(a)-
5	pent(a)-
6	hex(a)-
7	hept(a)-
8	oct(a)-
9	non(a)-
10	dec(a)-



# Naming Hydrates

Given that the oxide ion is  $\text{O}^{2-}$ , what is the name for  $\text{PbO}_2 \cdot 6 \text{H}_2\text{O}$ ?

- A. lead oxide hexahydrate
- B. monolead dioxide hexahydrate
- C. lead(II) oxide hexahydrate
- D. lead oxide(II) hexahydrate
- E. lead(IV) oxide hexahydrate



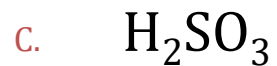
# Naming Oxyacids

- Oxyacids are compounds of hydrogen with a polyatomic ion
  - ▣ If the polyatomic ion ends in “ite” change it to “ous” followed by acid
  - ▣ If the polyatomic ion ends in “ate” change it to “ic” followed by acid Ex. nitrous acid and nitric acid
  - ▣ For sulfate and sulfite, modify the stem to appear sulfuric acid and sulfurous acid
  - ▣ For phosphate and phosphite, modify the stem to appear phosphoric and phosphorous acid



# Naming Oxyacids

Name the following acids





# Naming Oxyacids

Given that the bromate ion is  $\text{BrO}_3^-$ , what is the name for  $\text{HBrO}_3$ ?

- A. hydrogen bromine trioxide
- B. hydrobromic acid
- C. bromate acid
- D. bromic acid
- E. bromous acid



# Naming Binary Acids

- Binary acids consist of one or two hydrogen atoms bonded to a monoatomic anion of a group 16 or 17 element
  - ▣ Modify the stem of the characteristic stem of the nonmetal with the prefix “hydro” and the suffix “ic” followed by acid
    - Ex. HCl (aq) hydrochloric acid



# Naming Binary Acids

Name the following compounds

A. HBr

B. HF

C. H<sub>2</sub>S



# Nomenclature Review

Name the following substances

- A.  $\text{N}_2\text{O}_4$
- B.  $\text{Br}^-$
- C.  $\text{PCl}_5$
- D.  $\text{HI}$
- E.  $\text{HClO}_4$
- F.  $\text{Be}(\text{NO}_2)_2$
- G.  $\text{Cr}_3(\text{PO}_3)_2$
- H.  $\text{PbCO}_3$
- I.  $\text{Cu}^{3+}$