

## FORMULAS AND NAMES OF COMMON IONS: Simple Anions

### Group 1A

$H^{1-}$  hydride ion

### Group 4A

$C^{4+}$  carbide ion

$C_2^{2-}$  acetylide ion

### Group 5A

$N^{3-}$  nitride ion

$P^{3-}$  phosphide ion

### Group 6A

$O_2^{2-}$  peroxide ion

$O_2^{1-}$  superoxide ion

$O^{2-}$  oxide ion

$S^{2-}$  sulfide ion

$Se^{2-}$  selenide ion

$Te^{2-}$  telluride ion

### Group 7A

$F^{1-}$  fluoride ion

$Cl^{1-}$  chloride ion

$Br^{1-}$  bromide ion

$I^{1-}$  iodide ion

$At^{1-}$  astatide ion

## FORMULAS AND NAMES OF COMMON POLYATOMIC IONS:

### Group 3A

$BO_3^{3-}$  borate ion

### Group 4A

$CO_3^{2-}$  carbonate ion

$HCO_3^{1-}$  hydrogen carbonate ion

$C_2O_4^{2-}$  oxalate ion

$HC_2O_4^{1-}$  hydrogen oxalate ion

$C_2H_3O_2^{1-}$  acetate ion

$CN^{1-}$  cyanide ion

$CNO^{1-}$  cyanate ion

$SiO_4^{4-}$  silicate ion

### Group 5A

$NH_4^+$  ammonium ion

$NO_2^{1-}$  nitrite ion

$NO_3^{1-}$  nitrate ion

$PO_3^{3-}$  phosphite ion

$HPO_3^{2-}$  monohydrogen phosphite ion

$H_2PO_3^{1-}$  dihydrogen phosphite ion

$PO_4^{3-}$  phosphate ion

$HPO_4^{2-}$  monohydrogen phosphate ion

$H_2PO_4^{1-}$  dihydrogen phosphate ion

$AsO_4^{3-}$  arsenate ion

$HAsO_4^{2-}$  monohydrogen arsenate ion

$H_2AsO_4^{1-}$  dihydrogen arsenate ion

### Group 6A

$OH^{1-}$  hydroxide ion

$HS^{1-}$  hydrogen sulfide ion

$SO_3^{2-}$  sulfite ion

$HSO_3^{1-}$  hydrogen sulfite ion

$SO_4^{2-}$  sulfate ion

$HSO_4^{1-}$  hydrogen sulfate ion

$S_2O_3^{2-}$  thiosulfate ion

$SCN^{1-}$  thiocyanate ion

$HSe^{1-}$  hydrogen selenide ion

$SeO_4^{2-}$  selenate ion

$HSeO_4^{1-}$  hydrogen selenate ion

$HTe^{1-}$  hydrogen telluride ion

$TeO_4^{2-}$  tellurate ion

$HTeO_4^{1-}$  hydrogen tellurate ion

### Group 7A

$ClO^{1-}$  hypochlorite ion

$BrO^{1-}$  hypobromite ion

$IO^{1-}$  hypoiodite ion

$ClO_2^{1-}$  chlorite ion

$ClO_3^{1-}$  chlorate ion

$BrO_3^{1-}$  bromate ion

$IO_3^{1-}$  iodate ion

$ClO_4^{1-}$  perchlorate ion

$BrO_4^{1-}$  perbromate ion

$IO_4^{1-}$  periodate ion

### Transition Metals

$CrO_4^{2-}$  chromate ion

$Cr_2O_7^{2-}$  dichromate ion

$MnO_4^{2-}$  manganate ion

$MnO_4^{1-}$  permanganate ion

$Hg_2^{2+}$  mercury(I) ion

(mercurous ion)

## FORMULAS AND NAMES OF COMMON IONS: "A" Group Cations

### Group 1A (all +1 ions)

$H^{1+}$	hydrogen ion
$Li^{1+}$	lithium ion
$Na^{1+}$	sodium ion
$K^{1+}$	potassium ion
$Rb^{1+}$	rubidium ion
$Cs^{1+}$	cesium ion
$Fr^{1+}$	francium ion

### Group 2A (all +2 ions)

$Be^{2+}$	beryllium ion
$Mg^{2+}$	magnesium ion
$Ca^{2+}$	calcium ion
$Sr^{2+}$	strontium ion
$Ba^{2+}$	barium ion
$Ra^{2+}$	radium ion

### Group 3A (+1 and +3 ions)

$Al^{3+}$	aluminum ion
$Ga^{3+}$	gallium ion
$In^{3+}$	indium ion
$Tl^{1+}$	thallium(I) ion (thallous ion)
$Tl^{3+}$	thallium(III) ion (thallic ion)

### Group 4A (+2 and +4 ions)

$Sn^{2+}$	tin(II) ion (stannous ion)
$Sn^{4+}$	tin(IV) ion (stannic ion)
$Pb^{2+}$	lead(II) ion (plumbous ion)
$Pb^{4+}$	lead(IV) ion (plumbic ion)

### Group 5A (+3 and +5 ions)

$Bi^{3+}$	bismuth(III) ion
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## FORMULAS AND NAMES OF COMMON IONS: Transition Metal Cations

### Group 3B

$Sc^{3+}$	scandium(III) ion
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### Group 4B

$Ti^{3+}$	titanium(III) ion (titanous ion)
$Ti^{4+}$	titanium(IV) ion (titanic ion)

### Group 5B

$V^{2+}$	vanadium(II) ion (vanadous ion)
$V^{3+}$	vanadium(III) ion (vanadic ion)

### Group 6B

$Cr^{2+}$	chromium(II) ion (chromous ion)
$Cr^{3+}$	chromium(III) ion (chromic ion)

### Group 7B

$Mn^{2+}$	manganese(II) ion (manganous ion)
$Mn^{3+}$	manganese(III) ion (manganic ion)

### Group 8 (Iron Family)

$Fe^{2+}$	iron(II) ion (ferrous ion)
$Fe^{3+}$	iron(III) ion (ferric ion)

### Group 8 (Cobalt Family)

$Co^{2+}$	cobalt(II) ion (cobaltous ion)
$Co^{3+}$	cobalt(III) ion (cobaltic ion)

### Group 8 (Nickel Family)

$Ni^{2+}$	nickel(II) ion (nickelous ion)
$Ni^{3+}$	nickel(III) ion (nickelic ion)
$Pd^{2+}$	palladium(II) ion (palladous ion)
$Pd^{4+}$	palladium(IV) ion (palladic ion)
$Pt^{2+}$	platinum(II) ion (platinous ion)
$Pt^{4+}$	platinum(IV) ion (platinic ion)

### Group 1B

$Cu^{1+}$	copper(I) ion (cuprous ion)
$Cu^{2+}$	copper(II) ion (cupric ion)
$Ag^{1+}$	silver(I) ion (argentous ion)
$Ag^{3+}$	silver(III) ion (argentic ion)
$Au^{1+}$	gold(I) ion (aurous ion)
$Au^{3+}$	gold(III) ion (auric ion)

### Group 2B

$Zn^{2+}$	zinc ion
$Cd^{2+}$	cadmium ion
$Hg_2^{2+}$	mercury(I) ion (mercurous ion)
$Hg^{2+}$	mercury(II) ion (mercuric ion)

## Classes of Inorganic Compounds

### Ionic Compounds

binary metal-nonmetal compounds	salt	NaCl
ternary metal-nonmetal compounds	salt	Na <sub>2</sub> SO <sub>4</sub>
quaternary metal-nonmetal compounds	acid salt	NaHSO <sub>4</sub>

### Molecular Compounds

binary nonmetal-nonmetal compounds	molecule	CO <sub>2</sub>
	network covalent	SiO <sub>2</sub>

### Acids (substances that dissociate to produce H<sup>+</sup>(aq.) when dissolved in water)

binary hydrogen-nonmetal compounds	acid	HCl(aq.)
ternary hydrogen-radical ion compounds	acid	H <sub>2</sub> SO <sub>4</sub> (aq.)

### Bases (substances that yield OH<sup>-</sup>(aq.) when dissolved in water)

metal hydroxides (ternary)	base	NaOH
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### Hydrates (substances that contain molecular H<sub>2</sub>O in their structure)

-of ionic compounds	salt hydrate	Na <sub>2</sub> CO <sub>3</sub> • 10 H <sub>2</sub> O
-of molecular compounds	molecular hydrate	CO <sub>2</sub> • H <sub>2</sub> O

## Ionic Compounds

### Writing Their Names

- Write the cation name first.
- Write the anion name last.

### Writing Their Formulas

- Write the cation formula first, complete with charge.
- Write the anion formula second, complete with charge.
- Balance total cation charge with total anion charge by choosing subscripts to multiply the number of cations and/or anions in the formula.
- Erase all charges.

## Molecular Compounds

### Writing Their Names

- Write the complete name of the more metallic element first. Use a prefix to indicate the number of this type of atom.
- Write the stem word of the more nonmetallic element second. Add "ide" to form the anion name. Use a prefix to indicate the number of this type of atom.

### Writing Their Formulas

- Write the symbol of the more metallic element first.
- Write the symbol of the more nonmetallic element last.
- Translate prefixes into the number of each atom present. Write this number as a subscript to the element symbol.

Prefixes		Stem Words						
Prefix	No.	Prefix	No.	B bor	C carb	N nitr	O ox	F fluor
mono	1	hexa	6		Si silic	P phosph	S sulf	Cl chlor
di	2	hepta	7			As arsen	Se selen	Br brom
tri	3	octa	8			Sb stibn	Te tellur	I iod
tetra	4	nona	9					At astat
penta	5	deca	10					

## Acids

### Writing Their Names

1. Find the anion by removing all first position  $H^+$  from the formula.
2. Name the anion. Then find the stem word of the anion by removing its suffix. Special stems: S = sulfur and P = phosphor.
3. Name the acid by adding an appropriate prefix and/or suffix to the stem word of the anion and by adding the word "acid."

Anion	Acid
-ide	hydro- -ic acid
hypo- -ite	hypo- -ous acid
-ite	-ous acid
-ate	-ic acid
per- -ate	per- -ic acid

### Writing Their Formulas

1. Write  $H^+$  first.
2. Translate the acid name into an anion formula. Write the anion formula last.
3. Use a subscript to  $H^+$  to balance anion charge with cation charge.
4. Erase all charges.

## Bases

### Writing Their Names

1. Write the name of the cation first.
2. Write hydroxide last.

### Writing Their Formulas

1. Write the cation symbol first, complete with charge.
2. Write  $OH^-$  last.
3. Use a subscript to (OH) to balance cation and anion charge.
- b. Erase all charges.

## Hydrates

### Writing Their Names

1. Write the name of the compound, ignoring associated water molecules.
2. Add "hydrate" to the name of the compound.
3. Use a prefix to "hydrate" to indicate the number of water molecules.

### Writing Their Formulas

1. Write the formula of the compound, ignoring "(prefix)hydrate."
2. Add  $H_2O$  to the formula of the compound.
3. Use a prefix number to  $H_2O$  to indicate the number of water molecules.

### Common Names of Some Molecular Compounds

$B_2H_6$	diborane	$NH_3$	ammonia
		$PH_3$	phosphine
		$AsH_3$	arsine
		$SbH_3$	stibine
$CH_4$	methane		
$SiH_4$	silane	$H_2O$	water
$GeH_4$	germane	$H_2S$	hydrogen sulfide
$SnH_4$	stannane		