

Basic Skills for Chemistry

CHEM-1020

Chapter 7 Lecture Notes

Kroschwitz, 3rd edition

Formation and Nomenclature of Chemical Compounds

Formulas of Ionic Compounds

Rules for naming and writing formulas

- Cation name written first, then anion name
- The sum of the positive and negative charges MUST equal zero.
- Subscripts for numbers of each ion
- Parentheses to set off polyatomic ions
- Use smallest possible whole number ratio of ions

Examples of Common Ionic Compound Formulas

sodium chloride	potassium iodide	1	lithium bromide
sodium hydroxide	potassium nitrate		potassium cyanide
calcium chloride	calcium hydroxide		magnesium hydroxide
aluminum hydroxide	aluminum oxide		aluminum sulfide
aluminum phosphate	aluminum phosphide		
calcium oxide	zinc oxide		magnesium sulfide
sodium carbonate	lithium carbonate		calcium carbonate
sodium bicarbonate	calcium bicarbonate		aluminum bicarbonate
sodium phosphate			
sodium monohydrogen phosphate	sodium dihydrogen phosphate		
calcium phosphate	calcium hydroxyphosphate		
sodium sulfate	barium sulfate		aluminum sulfate
sodium sulfite	sodium hydrogen sulfite		
ammonium chloride	ammonium sulfate		ammonium phosphate
ammonium nitrate	calcium nitrate		aluminum nitrate
potassium hydride	calcium hydride		aluminum hydride
ferrous oxide	ferric oxide		
copper (I) oxide	copper (II) sulfide		
stannous nitrate	stannic nitrate		
chromium (II) oxide	chromium (III) oxide		chromium (VI) oxide

Binary Covalent Compounds

Covalent bonds result from the *sharing* of electrons.

Covalent compounds typically form between two *nonmetals*.

Ions cannot form if there is no metal to donate electrons.

Nomenclature of Binary *Molecular* Compounds

Trivial Names

A few binary covalent compounds have “trivial” names.

Water, ammonia, methane, phosphine

Systematic Names

Many molecular compounds are named by rules similar to those for ionic compounds.

- The more metallic element is placed first. The name of that element is not changed.
- The more nonmetallic element is placed second and given the –ide suffix.
- When more than one compound exists, Greek prefixes differentiate between them.

carbon monoxide

phosphorus trichloride

the six nitrogen oxides, NO_x

Carbon tetrachloride

sulfur fluoride

diphosphorus hexoxide

chlorine oxide

hydrogen fluoride

carbon dioxide

phosphorus pentachloride

sulfur tetrafluoride

tetraphosphorus decoxide

oxygen fluoride

hydrogen chloride

sulfur hexafluoride

hydrogen bromide

hydrogen iodide

Aqueous Acid Nomenclature

An acid is a hydrogen ion donor.

(Do not name acids as compounds of hydrogen)

Hydrohalogen Acids

Hydrofluoric acid

Hydrochloric acid

Hydrobromic acid

Hydriodic acid

Oxoacids

Relationship of oxoacids to their anions

Hydrofluoric acid

Sulfuric acid

Nitric acid

Phosphoric acid

Carbonic acid

Acetic acid

Hydrochloric acid

sulfurous acid

nitrous acid

Hydrobromic acid

Hydriodic acid

Formula Weight

Aka Molecular Mass, Formula Mass, Molecular Weight
(Which is the best term?)

Formula weight is the sum of the atomic masses in a formula
Units are amu, grams/mole or Daltons
(When should each be used?)

Molecular weight refers properly only to molecular substances
H₂O CCl₄

Use *Formula Weight* or *Formula Mass* when referring to ionic compounds
No molecules exist but the lowest whole number ratio of ions is shown.

NaCl Ca(NO₃)₂

Why is hydrogen peroxide written H₂O₂ instead of HO?

Concept of *Empirical Formula*

Differences among CH, C₂H₂, and C₆H₆.

Percentage Composition

What is the need for knowing Percentage Composition, aka (percentage by weight)?
How is Percentage Composition determined experimentally for an unknown substance?

How is Percentage Composition determined mathematically from the formula of a known substance?

$\% = (\text{part/whole}) \times 100\%$

Add up the atomic masses of each element (part)

Divide by the formula mass of the compound formula (whole)

Units and sig figs?

Percentage Composition of H₂O, H₂O₂ etc.