

## CHAPTER 9

The oxidation number is the charge that an atom appears to have when electrons are counted with the more electronegative atom.

### RULES FOR OXIDATION NUMBERS

1. Any element in the elemental state (free state, not combined with another element) has an oxidation number of zero  
O<sub>2</sub> O<sub>3</sub> P<sub>4</sub> K
2. The oxidation number of any monatomic ion is equal to the charge on the ion  
K<sup>+</sup> O<sup>2-</sup>
3. Fluorine always has an oxidation number of -1 in a compound  
HF CF<sub>4</sub> OF<sub>2</sub>
4. Oxygen has an oxidation number of -2 in compounds except in peroxides, H<sub>2</sub>O<sub>2</sub>, and OF<sub>2</sub>  
H<sub>2</sub>O H<sub>2</sub>SO<sub>4</sub> CO<sub>2</sub>
5. Hydrogen has an oxidation number of +1 in compounds except when combined with metals in binary compounds, where it has an oxidation number of -1  
HF H<sub>2</sub>O H<sub>2</sub>SO<sub>4</sub> H<sub>2</sub>O<sub>2</sub> LiH
6. The alkali metals have an oxidation number of +1 in compounds: NaCl KI
7. The alkaline earth metals have an oxidation number of +2 in compounds: CaO MgCl<sub>2</sub>
8. The halogens have an oxidation number of -1 when combined with metals in binary compounds  
NaCl CaI<sub>2</sub>
9. The nonmetals of group 6a have an oxidation number of -2 when combined with metals in binary compounds  
CaS K<sub>2</sub>S

## CHAPTER 9

10. For neutral compounds the sum of the oxidation number of all the atoms must equal zero



11. For polyatomic ions the sum of the oxidation number of all the atoms in the ion must equal the charge on the ion



### I. BINARY COMPOUNDS

#### A. METALS + NONMETALS (SALTS)

1. The metal has only one charge in compounds

[ Group 1A, 2A,  $\text{Al}^{+3}$  (group 3A),  $\text{Zn}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Ag}^+$  ]

Name of Metal + Stem of nonmetal + -ide

2. The metal has more than one charge in compounds.

Name of metal + charge on metal + stem of nonmetal + -ide  
as a Roman Numeral  
in parentheses

#### Stems of nonmetals

Group 4A	Group 5A	Group 6A	Group 7A
C: carb	N: nitr	O: ox	F: fluor
Si: silic	P: phosph	S: sulf	Cl: chlor
	As: arsen	Se: selen	Br: brom
		Te: tellur	I: iod

#### B. NONMETAL + NONMETAL

First + name of first + second + stem of second + -ide  
prefix nonmetal prefix nonmetal

1. Greek prefix indicates the number of atoms per molecule
2. If first prefix is mono-, omit it

#### Greek Prefixes

1 - mono	5 - penta	9 - nonna
2 - di	6 - hexa	10 - deca
3 - tri	7 - hepta	
4 - tetra	8 - octa	

C. ACIDS: HYDROGEN + NONMETAL

1. Not in aqueous solution *(name the anion)*
  - a. word hydrogen + stem of nonmetal + -ide
  - b. nonmetal in group 6A or 7A
  
2. In aqueous solution  
Prefix hydro + stem of nonmetal + ic + word acid

II. TERNARY COMPOUNDS (Composed of three elements)

A. SALTS

1. Metal has only one charge

Name of Metal + Name of Anion

$K_2SO_4$  potassium sulfate

2. For metals with more than one charge, include the charge as a Roman numeral in parenthesis

Name of metal + charge on metal + Name of anion

- a. Names of polyatomic ions in textbook  
(Dewey p251)

$FeSO_4$  iron(II) sulfate

3. NONMETAL CATION AND ANION

Name of Cation + Name of Anion

$(NH_4)_2SO_4$  ammonium sulfate

## CHAPTER 9

### B. ACIDS

1. If the name of the polyatomic ion in the acid ends in -ate the acid name ends in -ic

$\text{H}_2\text{SO}_4$  contains the sulfate ion,  $\text{SO}_4^{-2}$

Thus the name of the acid is sulfuric acid.

$\text{HClO}_4$  - perchloric acid from the perchlorate ion

$\text{HClO}_3$  - chloric acid from chlorate ion

2. If the name of the polyatomic ion in the acid ends in -ite the acid name ends in -ous

$\text{H}_2\text{SO}_3$  contains the sulfite ion,  $\text{SO}_3^{-2}$

Thus the name of the acid is sulfurous acid

Note that the -ous acid has one less oxygen than the -ic acid

$\text{HClO}$  - hypochlorous acid from the hypochlorite ion

$\text{HIOAg}$  -

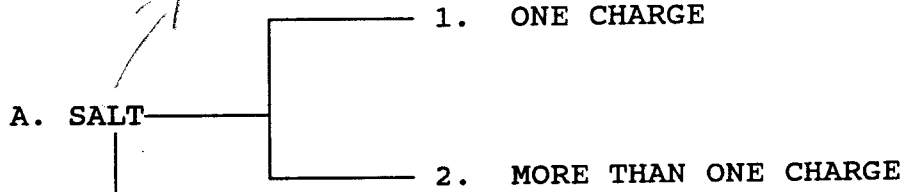
### III. HYDRATES

Name of Anhydrous Salt + Greek Prefix + word hydrate

1. Greek prefix indicates the number of water molecules in the compound

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  copper(II) sulfate pentahydrate

$\text{Ba}_3(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$  barium phosphate dihydrate



I. BINARY

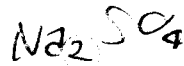
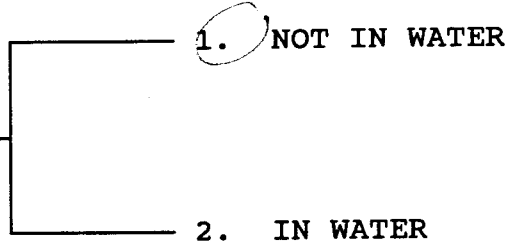
B. MOLECULAR *- 2 molecules*



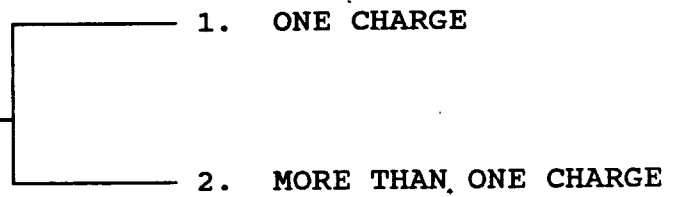
hydrogen chloride



C. ACID

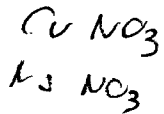
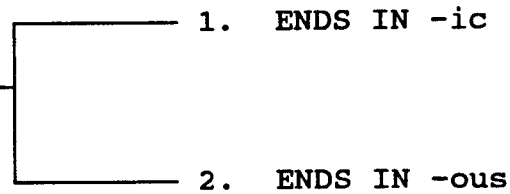


A. SALT



II. TERNARY

B. ACID



CHAPTER 9

A. Write the formula of the following compounds:

1. copper(I) oxide
2. copper(II) oxide
3. sulfur dichloride
4. hydrosulfuric acid
5. hydrogen fluoride

B. Write the name of the following

1.  $\text{IF}_6$
2.  $\text{Ag}_2\text{O}$
3.  $\text{P}_4\text{S}_{10}$
4.  $\text{HBr}(\text{aq})$
5.  $\text{Cl}_2\text{O}_5$
6.  $\text{HI}$

### 30. OXIDATION NUMBERS

---

1. Determine the oxidation number of each element in

- |             |                 |
|-------------|-----------------|
| a. $O_2$    | k. $H_2SO_4$    |
| b. $CO$     | l. $SO_4^{2-}$  |
| c. $CO_2$   | m. $Na^+$       |
| d. $H_2O_2$ | n. $LiH$        |
| e. $Cl_2$   | o. $BrO_3^-$    |
| f. $HCl$    | p. $F_2$        |
| g. $KCl$    | q. $HF$         |
| h. $HClO_3$ | r. $F_2O$       |
| i. $S_8$    | s. $KMnO_4$     |
| j. $H_2S$   | t. $K_2Cr_2O_7$ |

2. Calculate the oxidation number of nitrogen in

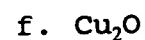
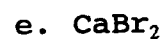
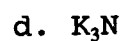
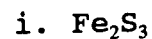
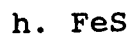
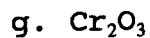
- |                 |             |
|-----------------|-------------|
| a. $NH_3$       | h. $N_2O$   |
| b. $NH_4^+$     | i. $NH_2OH$ |
| c. $NO_2$       | j. $KNO_2$  |
| d. $N_2O_3$     | k. $Na_3N$  |
| e. $HNO_3$      | l. $KNH_2$  |
| f. $NO_3^-$     | m. $NO_2^-$ |
| g. $Ca(NO_3)_2$ | n. $NO$     |

3. Calculate the oxidation number of carbon in
- a.  $\text{CH}_4$
  - b.  $\text{CH}_4\text{O}$
  - c.  $\text{CH}_2\text{O}$
  - d.  $\text{CO}$
  - e.  $\text{CH}_2\text{O}_2$
  - f.  $\text{CO}_2$
4. What is the value of the electronegativity for
- a. H
  - b. C
  - c. O
  - d. N
5. Calculate the oxidation number of carbon in
- a.  $\text{C}_4\text{H}_6\text{O}_5$
  - b.  $\text{C}_3\text{H}_4\text{O}_3$
  - c.  $\text{C}_3\text{H}_6\text{O}_3$

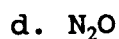
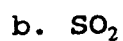
43. INORGANIC NOMENCLATURE

---

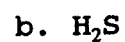
1. Name the following compounds



2. Name the following compounds



3. Name the following compounds



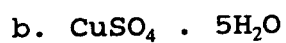
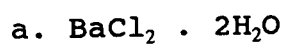
4. Name the following compounds



5. Name the following compounds



6. Name the following compounds



7. Give the formula of the following compounds

a. copper (II) chloride

b. dinitrogen monoxide

c. copper (I) chloride

d. copper (II) sulfate

e. copper (I) sulfate

f. sodium acetate

g. potassium chlorate

h. iron (II) dichromate

i. dinitrogen tetroxide

j. phosphorus pentachloride

k. ammonium sulfate

l. hydrofluoric acid

m. hydrogen fluoride

n. barium hydroxide

o. tin (IV) oxide

p. magnesium phosphide