Redox Reactions

Reduction- Oxidation Reaction – reaction involving transfer of electrons.

reductions means GAINS electrons

oxidation — LOSES electrons

OILRIG

Oxidation #s (aka Oxidation State)

* The # of electrons an element has gained or lost (typically...)

Neg oxidation #'s → gained electrons
change more <u>neg</u>
* reduced

Pos oxidation #s → lost electrons
change more <u>pos</u>
* oxidized

worth Noting → Flourine is <u>most</u> electronegative element.

Oxygen is <u>2nd</u>

Rules for Finding Oxidation States / #s

* in general, think of ionic compounds as their seperate ions. → metals + non-metals

$NaCl \rightarrow Na^+ \ Cl^-$

$Na_2SO_4 \rightarrow Na^+ \ SO_4^{2-}$

1. For monatomic ion - oxidation is equal to charge (magnitude & direction)

$Fe^{2+} \rightarrow +2$ $Al^{3+} \rightarrow +3$

$F^- \rightarrow -1$ $Cl^- \rightarrow -1$

2. Hydrogen is +1 <u>EXCEPT</u> in metal halides (a metal + Hydrogen NaH)

3. Oxygen is -2 <u>EXCEPT</u> in Peroxides (H_2O_2), it will be -1 <u>AND</u> with Flourine alone, (it be +)

4. In elemental form (Li, Cl_2) even if diatomic the oxidation # is Ø.

5. For a neutral compound, the sum of oxidation #'s is Ø.

6. For a polyatomic ion (PO_4^{3-}) the sum of oxidation # is equal to charge.

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* Oxidation # - don't count subscripts

only use subscripts to find <u>sum</u> of ox #'s & balance compounds

Free Guide to Naming Compounds - Glue Into your Lab Book

Model 1 – Ion Charges for Selected Elements

1	H^{+}											
2	Li^{+}	Be^{2+}							N^{3-}	O^{2-}	F^{1-}	
3	Na^{+}	Mg^{2+}	Transition elements				Al^{3+}		P^{3-}	S^{2-}	Cl^{1-}	
4	K^{+}	Ca^{2+}	Fe^{2+} Fe^{3+}	Ni^{2+} Ni^{3+}	Cu^{+} Cu^{2+}	Zn^{2+}					Br^{1-}	
5	Rb^{+}	Sr^{2+}			Ag^{1+}			Sn^{2+} Sn^{4+}			I^{1-}	
6		Ba^{2+}				Hg_2^{2+} Hg^{2+}		Pb^{2+} Pb^{4+}				

← Cations → ← Anions →

IONIC

Ionic Compound Names (Metals that form one ion)

NaCl	Sodium chloride	Zn_3P_2	Zinc phosphide
CaS	Calcium sulfide	Al_2O_3	Aluminum oxide
Ag_2S	Silver sulfide	$SrCl_3$	Strontium chloride

Ionic Compound Names (Metals that form multiple ions)

Cu_2O	Copper(I) oxide
CuO	Copper(II) oxide
SnF_2	Tin(II) fluoride
SnF_4	Tin(IV) fluoride
PbO	Lead(II) oxide
PbO_2	Lead(IV) oxide
$FeCl_2$	Iron(II) chloride
$FeCl_3$	Iron(III) chloride

Model 2 – Common Polyatomic Ions

1+		1–		2–		3–	
ammonium	NH_4^{1+}	acetate	CH_3COO^{1-}	sulfate	SO_4^{2-}	phosphate	PO_4^{3-}
		hydroxide	OH^{1-}	sulfite	SO_3^{2-}		
		nitrate	NO_3^{1-}	carbonate	CO_3^{2-}		
		nitrite	NO_2^{1-}	chromate	CrO_4^{2-}		
		bicarbonate	HCO_3^{1-}	dichromate	$Cr_2O_7^{2-}$		
		permanganate	MnO_4^{1-}				
		perchlorate	ClO_4^{1-}				
		chlorate	ClO_3^{1-}				
		chlorite	ClO_2^{1-}				
		hypochlorite	ClO^{1-}				

Model 2 – Prefixes and Suffixes

Prefix	Numerical Value
mono-	
di-	
tri-	
tetra-	
penta-	
hexa-	
hepta-	
octa-	
nona-	
deca-	

Molecular Formula	Name of Compound
BCl_3	Boron trichloride
SF_6	Sulfur hexafluoride
IF_7	Iodine heptafluoride
NI_3	Nitrogen triiodide
N_2O_4	Dinitrogen tetroxide
Cl_2O	Dichlorine monoxide
P_4O_{10}	Tetraphosphorus decoxide
B_5H_9	Pentaboron nonahydride
Br_3O_8	Tribromine octoxide
ClF	Chlorine monofluoride

COVALENT

Hint: can't find it here? Google/wiki can often tell you the chem. formula

Hints + Different Approaches...

Oxidation States

* remember the oxidation # is telling us about gain/loss of electrons per atom. That's why subscripts aren't factored in when finding oxidation #s or their changes.

- we can use sum of oxidation #s to solve for unknown #'s (now we need those subscripts)
  - → can think of it as solving for unknown (see neutral compounds to ∅, polyatomic ions to their charge)

ex

$NH_3 \longrightarrow N + H + H + H = \varnothing$

or

$NO_3^- \longrightarrow N + O + O + O = -1$

* you'll need the naming compounds + common ions handout for this unit & test.