

Oxidation Number Exercise

Do not hand in this work sheet. When you are ready, you will be given an examination over this material. Complete the examination by yourself and hand it in to receive credit.

Purpose: This exercise is designed to teach the student how to assign oxidation numbers. Oxidation numbers are very important and are used for 1) naming compounds, 2) balancing oxidation-reduction reactions, 3) calculations in electrochemistry and other areas of chemistry.

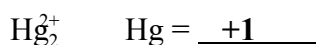
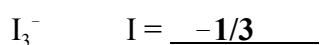
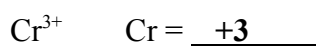
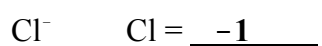
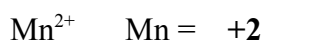
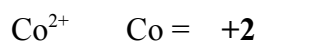
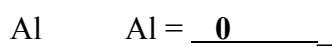
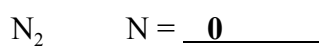
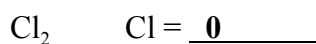
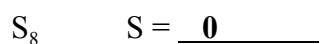
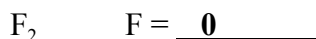
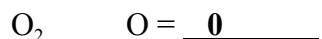
Rule 0 The following rules are in the form of a hierarchy; that is, the first stated rule takes precedence over subsequent rules if a conflict arises.

Rule 1 The oxidation numbers for all the atoms in a neutral molecule must add up to 0. Similarly, the oxidation numbers for all the atoms of an ion must add up to the charge of the ion. (You are expected to recognize polyions. For the common polyions, know their charges and their names. A summary of the common polyions appears at the end of this exercise. The first step is, always, to determine what polyions are present.)

Rule 1a The oxidation number of elements in the elemental form is 0. (Note - this rule is a direct consequence of rule 1. How so?)

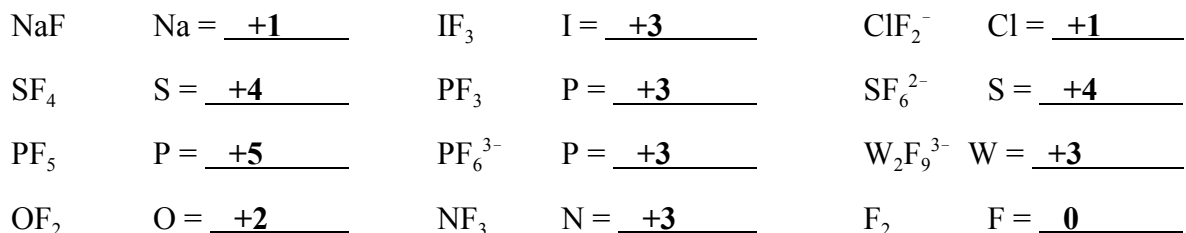
Rule 1b The oxidation number of any monatomic ion is the same as its charge. (See comment in 1a.)

Exercises - Give the oxidation number for the following atoms:



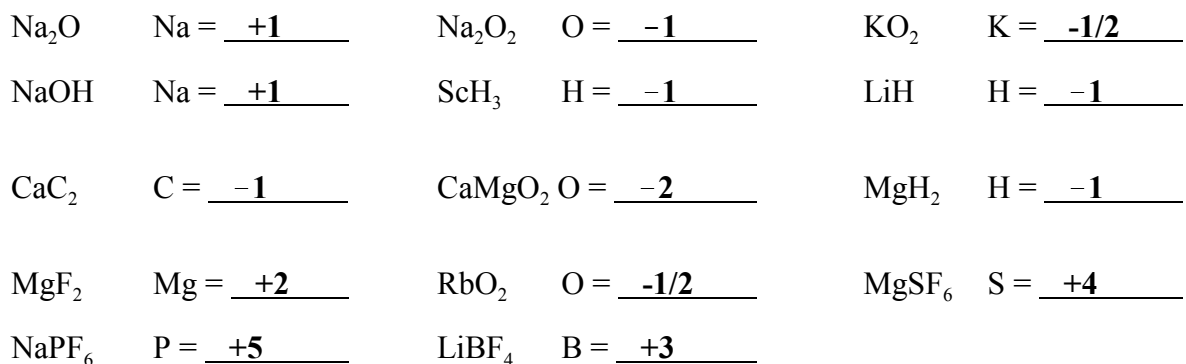
Rule 2 Fluorine has an oxidation number of -1.

Exercises - Give the oxidation number for the following atoms:



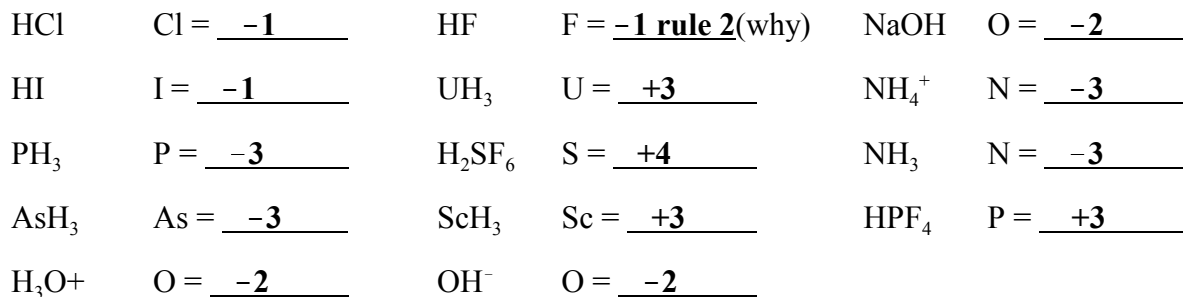
Rule 3 The metal of groups IA have an oxidation number of +1
The metal of groups IIA have an oxidation number of +2
Sc, Y and Al have an oxidation number of +3.

Exercises - Give the oxidation number for the following atoms:



Rule 4 Hydrogen has an oxidation number of +1 when combined with elements on the right side of the periodic chart (non-metals) and a -1 when combined with elements on the left side of the periodic chart (metals).

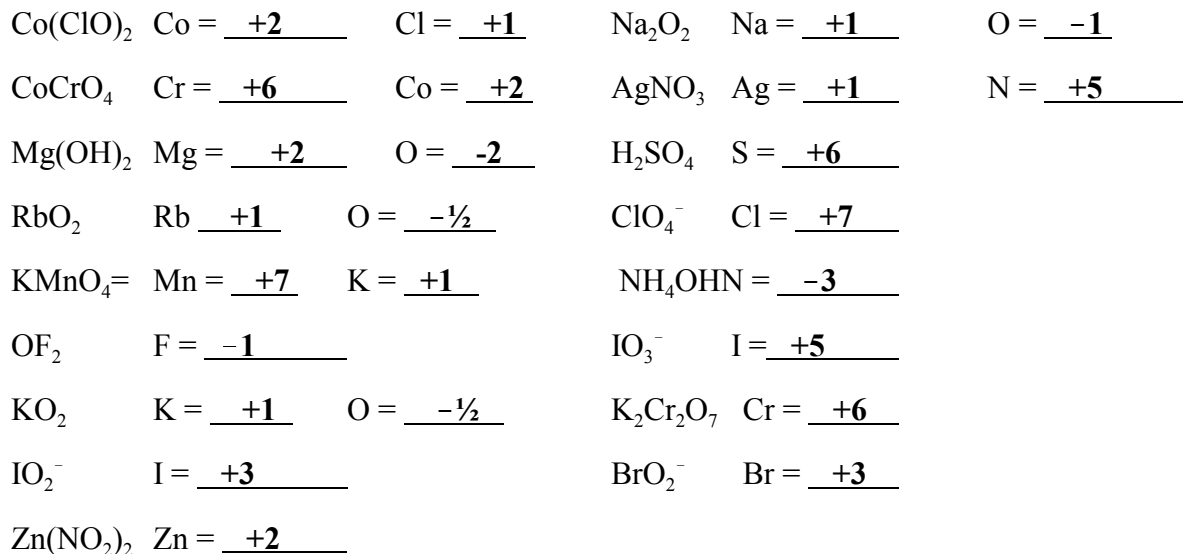
Exercises - Give the oxidation number for the following atoms:



Rule 5 Oxygen has an oxidation number of -2. (Note: Your knowledge of the polyions is now needed. See page 6.)

Cautionary Note: Review Rule 0

Exercises - Give the oxidation number for the following atoms:



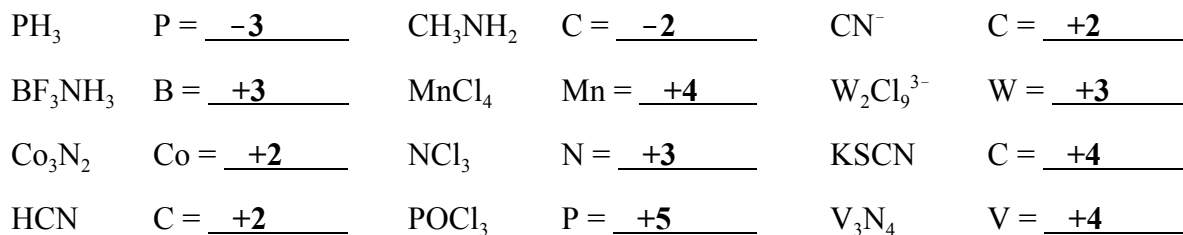
Cautionary Note: Review Rule 0 again

Rule 6 Group VIIA atoms have an oxidation number of -1.

Rule 7 Group VIA atoms have an oxidation number of -2.

Rule 8 Group VA atoms have an oxidation number of -3.

Exercises - Give the oxidation number for the following atoms:



Additional (Optional) Exercises:

NH ₃	N = <u>-3</u>	As ₂ O ₅	As = <u>+5</u>	SiF ₄	Si = <u>+4</u>
HNO ₃	N = <u>+5</u>	N ₂ H ₄	N = <u>-2</u>	PCl ₆ ⁻	P = <u>+5</u>
MnO ₂	Mn = <u>+4</u>	CrCl ₃	Cr = <u>+3</u>	Cr ₂ O ₇ ²⁻	Cr = <u>+6</u>
AgCH ₃ COO	Ag = <u>+1</u>	N ₂ O	N = <u>+1</u>	N ₂ O ₅	N = <u>+5</u>
Au ₂ O	Au = <u>+1</u>	AuO	Au = <u>+2</u>	CuSO ₄	Cu = <u>+2</u>
Os ₂ O ₅	Os = <u>+5</u>	Fe ₃ O ₄	Fe = <u>+8/3</u>	Fe ₂ O ₃	Fe = <u>+3</u>
FeO	Fe = <u>+2</u>	FePO ₄	Fe = <u>+3</u>	SiO ₂	Si = <u>+4</u>
H ₂ S	S = <u>-2</u>	FeS	S = <u>-2</u>	NaHCO ₃	C = <u>+4</u>
AuHCO ₃	Au = <u>+1</u>	ScAsO ₄	As = <u>+5</u>	NH ₄ OH	N = <u>-3</u>
SO ₃	S = <u>+6</u>	H ₂ CrO ₄	Cr = <u>+6</u>	H ₄ P ₂ O ₇	P = <u>+5</u>
Cl ₂	Cl = <u>0</u>	S ₂ O ₃ ²⁻	S = <u>+2</u>	MgC ₂	C = <u>-1</u>
S ₂ Cl ₂	S = <u>+1</u>	Cr ₂ (CO ₃) ₃	Cr = <u>+3</u>	K ₃ FeO ₄	Fe = <u>+5</u>
S ₈	S = <u>0</u>	BO ₂ ⁻	B = <u>+3</u>	Al ₂ O ₃	Al = <u>+3</u>
Ag ₂ CrO ₄	Ag = <u>+1</u>	RbO ₂	O = <u>-1/2</u>	I ₃ ⁻	I = <u>-1/3</u>
RbH	H = <u>-1</u>	Th ₄ H ₁₁	Th = <u>+11/4</u>	NaHSO ₄	S = <u>+6</u>
Na ₂ HPO ₄	P = <u>+5</u>	Eu ₃ (PO ₃) ₂	P = <u>+3</u>	B ₄ O ₇ ²⁻	B = <u>+3</u>
P ₄ O ₆	P = <u>+3</u>	BeF ₂	Be = <u>+2</u>	P ₄ O ₁₀	P = <u>+5</u>
OF ₂	F = <u>-1</u>	O = <u>+2</u>			
Ce(ClO ₃) ₂	Ce = <u>+2</u>	Cl = <u>+5</u>			
Fe(MnO ₄) ₂	Mn = <u>+7</u>	Fe = <u>+2</u>			
NaSCN	S = <u>-2</u>	C = <u>+4</u>	N = <u>-3</u>		