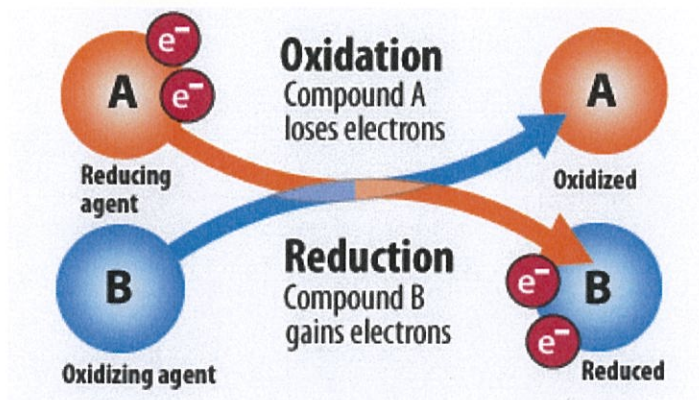


OXIDATION-REDUCTION (REDOX) REACTIONS



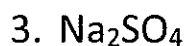
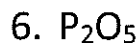
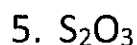
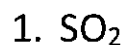
Crash Course Chemistry: REDOX REACTIONS!

1. What does Hank compare electrons to?
2. Why are reduction and oxidation bad names for what they mean?
3. Why is oxygen the “quintessential oxidizer”?
4. How are covalent compounds like marriages?
5. Example: $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$
 - a. Label each element's oxidation number
 - b. Determine which element is oxidized and which is reduced

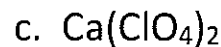
Rules for Assigning Oxidation Numbers

1. The oxidation number of a monatomic ion is equal to its ionic charge. For example, the oxidation number of bromide is -1 and the oxidation number of calcium is +2.
2. The oxidation number of hydrogen in a compound is +1.
3. The oxidation number of oxygen in a compound is -2, except for in compounds with the more electronegative fluorine, where it is positive.
4. The oxidation number of an atom in uncombined (elemental) form is zero. For example, the oxidation number of potassium atoms in potassium metal (K) or of the nitrogen atoms in nitrogen gas (N_2) is zero.
5. For any neutral compound, the sum of the oxidation numbers of the atoms in the compound must equal zero.
6. For a polyatomic ion, the sum of the oxidation numbers must equal the ionic charge of the ion.

Practice: Assigning Oxidation Numbers to Atoms



8. Determine the oxidation number of chlorine in each of the following substances:



Oxidation Numbers Worksheet

Directions: Use the *Rules for Assigning Oxidation Numbers* to determine the oxidation number assigned to each element in each of the given chemical formulas.

	Formula	Element and Oxidation Number		
1.	Cl ₂	Cl		
2.	Cl ⁻	Cl		
3.	Na	Na		
4.	Na ⁺	Na		
5.	O ₂	O		
6.	N ₂	N		
7.	Al ⁺³	Al		
8.	H ₂ O	H	O	
9.	NO ₃	N	O	
10.	NO ₂	N	O	
11.	Cr ₂ O ₇ ²⁻	Cr	O	
12.	KCl	K	Cl	
13.	NH ₃	N	H	
14.	CaH ₂	Ca	H	
15.	SO ₄ ²⁻	S	O	

	Formula	Element and Oxidation Number			
16.	Na ₂ O ₂	Na	O		
17.	SiO ₂	Si	O		
18.	CaCl ₂	Ca	Cl		
19.	PO ₄ ³⁻	P	O		
20.	MnO ₂	Mn	O		
21.	FeO	Fe	O		
22.	Fe ₂ O ₃	Fe	O		
23.	H ₂ O ₂	H	O		
24.	CaO	Ca	O		
25.	H ₂ S	H	S		
26.	H ₂ SO ₄	H	S	O	
27.	NH ₄ Cl	N	H	Cl	
28.	K ₃ PO ₄	K	P	O	
29.	HNO ₃	H	N	O	
30.	KNO ₂	K	N	O	

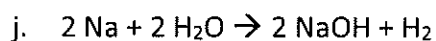
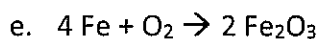
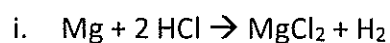
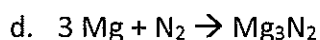
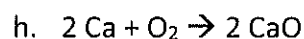
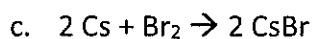
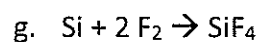
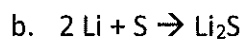
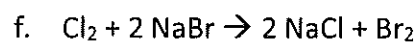
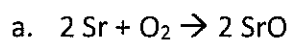
Rules for Assigning Oxidation Numbers

- The oxidation number of any uncombined element is 0.
- The oxidation number of a monatomic ion equals the charge on the ion.
- The more-electronegative element in a binary compound is assigned the number equal to the charge it would have if it were an ion.
- The oxidation number of fluorine in a compound is always -1.
- Oxygen has an oxidation number of -2 unless it is combined with F (when it is +2), or it is in a peroxide (such as H₂O₂ or Na₂O₂), when it is -1.
- The oxidation state of hydrogen in most of its compounds is +1 unless it is combined with a metal, in which case it is -1.
- In compounds, the elements of groups 1 and 2 as well as aluminum have oxidation numbers of +1, +2, and +3 respectively.
- The sum of the oxidation numbers of all atoms in a neutral compound is 0.
- The sum of the oxidation numbers of all atoms in a polyatomic ion equals the charge of the ion.

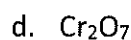
Answer Key									
1.	Cl:0	7.	Al:3+	13.	N:3- H:1+	19.	P:5+ O:2-	25.	H:1+ S:2-
2.	Cl:1-	8.	H:1+ O:2-	14.	Ca:2+ H:1-	20.	Mn:4+ O:2-	26.	H:1+ S:6+ O:2-
3.	Na:0	9.	N:5+ O:2-	15.	S:6+ O:2-	21.	Fe:2+ O:2-	27.	N:3- H:1+ Cl:1-
4.	Na:1+	10.	N:4+ O:2-	16.	Na:1+ O:1-	22.	Fe:3+ O:2-	28.	K:1+ P:5+ O:2-
5.	O:0	11.	Cr:6+ O:2-	17.	Si:4+ O:2-	23.	H:1+ O:1-	29.	H:1+ N:5+ O:2-
6.	N:0	12.	K:1+ Cl:1-	18.	Ca:2+ Cl:1-	24.	Ca:2+ O:2-	30.	K:1+ N:3+ O:2-

Redox Reaction Practice Problems

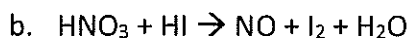
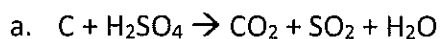
1. Determine what is oxidized and what is reduced in each reaction. Then identify the oxidizing agent (OA) and reducing agent (RA).

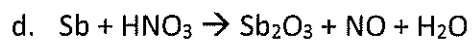


2. Determine the oxidation number of chromium in each of the following compounds.



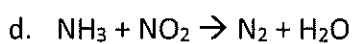
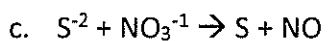
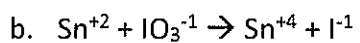
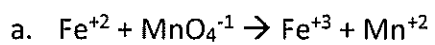
3. Use the changes in oxidation numbers to determine which elements are oxidized and which are reduced in these reactions.





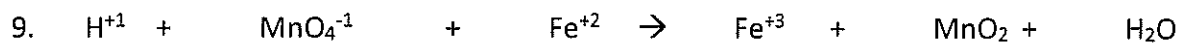
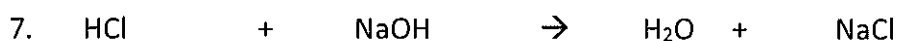
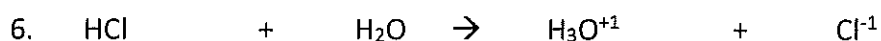
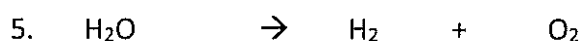
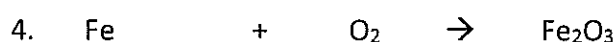
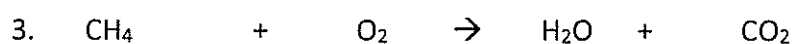
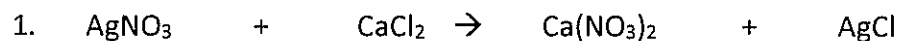
4. For each reaction in problem 3, identify the oxidizing agent and reducing agent.

5. Write half-reactions for the oxidation and reduction process for each of the following.



Redox Reaction Practice Problems

Classify the following reactions as redox or non-redox. If a reaction is a redox reaction, identify which element is oxidized and which is reduced. Then identify the oxidizing agent and reducing agent.



11. $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
12. $\text{Pb}(\text{NO}_3)_2 + \text{NaI} \rightarrow \text{PbI}_2 + \text{NaNO}_3$
13. $\text{PCl}_5 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + \text{HCl}$
14. $\text{Zn} + \text{Cu}^{+2} \rightarrow \text{Zn}^{+2} + \text{Cu}$
15. Are electrons lost or gained by an atom during the process of oxidation?
16. Does the oxidation number of an atom involved in the process of oxidation increase or decrease?
17. Are electrons lost or gained by an atom during the process of reduction?
18. Does the oxidation number of an atom involved in the process of reduction increase or decrease?