Name_____

# Oxidation and Reduction Study Guide

## Part I: Vocabulary and Terms

The loss of one or more electrons from an atom is called _____. The gain of electrons by an atom is called _____. Reduction and oxidation must go together, as electrons cannot be created or destroyed in a chemical reaction. A reaction where substances are oxidized and reduced is called a _____ reaction.

The _____ is defined as the number of electrons an atom needs to be given to return to its elemental form – the more positive this number is, the more oxidized an atom is, and the more negative this number is, the more reduced an atom is.

If an atom is oxidized in a reaction, it has a _____ oxidation number on the right-hand side of the equation than it does on the left. If an atom is reduced in a reaction, it has a _____ oxidation number on the right-hand side of the equation than it does on the left.

**Word Bank:** redox, oxidation, reduction, higher, lower, oxidation number.

## Part II: Assigning Oxidation Numbers.

**Rule 1:** The oxidation number of an uncombined element is always _____. This includes polyatomic elements like $H_2$.

**Rule 2:** The sum of the oxidation numbers of the atoms in a _____ compound is always zero. The sum of the oxidation numbers in an ion is equal to the _____ of that ion.

**Rule 3:** Metals in compounds generally have positive oxidation numbers. Group 1 metals always have an oxidation number of ____, and Group 2 metals have an oxidation number of _____.

**Rule 4:** Oxygen generally forms compounds with an oxidation number of _____. The most common exception is 'peroxide' compounds like _____, where oxygen has an oxidation number of -1.

**Rule 5:** Hydrogen usually forms compounds with an oxidation number of +1. The only common exception is binary metal-hydrogen compounds, or 'hydrides', such as _____ (lithium hydride), in which hydrogen has an oxidation number of -1.

**Rule 6:** Halogens usually form compounds where they have an oxidation number of _____. The only exceptions are when they bond to oxygen or to other halogens. Fluorine always has an oxidation number of -1 in any compound.

**Word Bank:** neutral, +2, -2, 0, -1, +1, $H_2O_2$, LiH, charge

Name_____

**Part II (Continued): Write the Oxidation States for all Atoms in these Compounds or Ions**

| | | |
|---|---|---|
| **$CO_2$** | **$NH_3$** | **$NO_2^-$** |
| **$NO_3^-$** | **$H_3PO_4$** | **$H_2O_2$** |

**Part III: Interpreting a Redox Reaction Equation (6 points)**

*Iodide ($I^-$) is a colorless, water-soluble ion. Reacting a solution of $Ce^{+4}$ ion with a solution containing iodide ion causes it to precipitate as the purple solid $I_2$.*
The UNBALANCED equation for this reaction is as follows:

$$I^- + Ce^{+4} \rightarrow I_2 + Ce^{+3}$$

12. (1 point) What is the oxidation number of iodide ($I^-$) on the left side of the equation? _____

13. (1 point) What is the oxidation number of Cerium on the left side? _____

14. (1 point) What is the oxidation number of iodine ($I_2$) on the right side of the equation? _____

15. (1 point) What is the oxidation number of Cerium on the right? _____

16. (1 point) Iodide is OXIDIZED or REDUCED in this reaction? _____

17. (1 point) Cerium is OXIDIZED or REDUCED in this reaction? _____

**Part IV: (HONORS) Balancing a Redox Equation by the Half-Reaction method (10 points)**

18. (2 points) Balance the oxidation half-reaction: ___$I^-$ → ___$I_2$ + ____$e^-$

19. (2 points) Balance the reduction half-reaction: ___$e^-$ + ___$Ce^{+4}$ → ____$Ce^{+3}$

20. (2 points) The total number of electrons needed to balance is the Least Common Multiple of the coefficient of $e^-$ in equation (18) and equation (19). What is it? _____

21. (1 point) Multiply all the coefficients of (18) by a constant so that the coefficient of $e^-$ is the answer to (20)
___$I^-$ → ___$I_2$ + ____$e^-$

22. (1 point) Multiply all the coefficients of (19) by a constant so that the coefficient of $e^-$ is the answer to (20)
___$e^-$ + ___$Ce^{+4}$ → ____$Ce^{+3}$

23. (2 points) Add together both sides of the half-reaction equations (21) and (22) and cancel the electrons to get a balanced redox equation for the overall reaction.