

What is oxidation and reduction?

Oxidation is the process of losing electrons. This makes the oxidation state (charge) more positive. Reduction is the gaining of electrons. This makes the oxidation state lower, or less positive. To know if a redox reaction (a reaction that has both oxidation and reduction) is occurring, you need to look for changes in a substances charge.

I like to use the pneumonic device **LEO** the lion goes **GER**!



(Lose Electrons is Oxidation, Gaining Electrons is Reduction)

Others prefer **OIL RIG**...

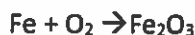
(Oxidation Is Losing electrons, Reduction Is Gaining electrons)



One key point is that if there is oxidation, there has to be reduction. The same for the reverse...if there is reduction, there has to be oxidation!

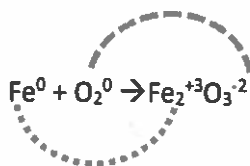
Think about it like two people. If one person gives 5\$, the other person HAS to take the 5\$! It doesn't just disappear. So, if one element changes a charge, so will the other, but in the opposite direction.

Let's look at this unbalanced reaction...



All ELEMENTS in their natural state are neutral. THIS IS NOT REFERRING TO COMPOUNDS (two or more different elements). It is easiest to look at the items differently. Since elements in their NORMAL state have no charge, their oxidation state is 0.

Going through the equation, I have written the charges above the elements.



1. What is happening to the Iron, Oxidation or Reduction AND WHY???
2. What is happening to the Oxygen, Oxidation or Reduction AND WHY???

We will call the following examples "half reactions" because we are literally breaking the reactions in half.



You can see the charge is going up, which means that the electrons are being lost. Since the iron is losing the electrons, it means that oxygen is gaining them (as seen by having a more negative charge in the products). Since Iron is GIVING THE ELECTRONS to oxygen, it is MAKING oxygen be reduced. Therefore it is the reducing agent.



You can see the charge is going down with oxygen, which means that the electrons are being gained. Since the oxygen is gaining the electrons, it means that Iron has to be losing them (as seen by having a more positive charge in the products). Since oxygen is TAKING THE ELECTRONS from iron, it is MAKING iron be oxidized. Therefore it is the oxidizing agent.

Think about the two people with the 5 dollars. If one person gives the 5\$ he is now the rich person maker, and "poor"...and the person taking the 5\$ is the poor person maker, and is now "rich."

3. If something is being reduced (meaning it is gaining electrons) what type of agent is it(oxidizing or reducing)? Why?
4. If something is being oxidized (meaning it is losing electrons) what type of agent is it(oxidizing or reducing)? Why?
5. Taking the following reactions, please identify the charges of each element. (Ignore the boxes to the right until told to do so in the following directions)



- | | |
|------|---------------------------|
| i. | Substance being Oxidized: |
| ii. | Substance being Reduced: |
| iii. | Oxidizing Agent: |
| iv. | Reducing Agent: |



- | | |
|-------|---------------------------|
| v. | Substance being Oxidized: |
| vi. | Substance being Reduced: |
| vii. | Oxidizing Agent: |
| viii. | Reducing Agent: |



- | | |
|------|---------------------------|
| ix. | Substance being Oxidized: |
| x. | Substance being Reduced: |
| xi. | Oxidizing Agent: |
| xii. | Reducing Agent: |



- | | |
|-------|---------------------------|
| xiii. | Substance being Oxidized: |
| xiv. | Substance being Reduced: |
| xv. | Oxidizing Agent: |
| xvi. | Reducing Agent: |

6. Now taking each of the reaction from above, please make brackets like shown on the previous page. It is most helpful to bracket each substance in different colors.
 - a. Looking at each bracket and ask yourself what change you see. Is the substance becoming more positive (oxidation) or becoming more negative (reduction).
7. Please identify which starting substance is undergoing oxidation in the boxes to the right of the equation.
8. Please identify which starting substance is undergoing reduction in the boxes to the right of the equation.
9. Please identify the oxidizing agent and the reducing agent in the boxes to the right of the equation.