

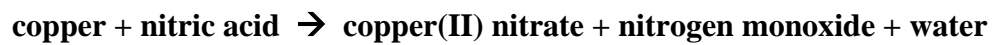
## Oxidation-Reaction Reactions

- 1) What is oxidation?
- 2) What is reduction?
- 3) What are the oxidation numbers in hydrogen peroxide,  $\text{H}_2\text{O}_2$ ?
- 4) What are the oxidation numbers in sulfite,  $\text{SO}_3^{2-}$ ?
- 5) What determines whether a chemical reaction is a redox reaction?
- 6) (a) What effect does oxidation have on the oxidation number of a substance?  
(b) What effect does reduction have on the oxidation number of a substance?
- 7) What is the difference between an oxidizing agent and a reducing agent?
- 8) Why are the Group I elements (alkali metals) very strong reducing agents?
- 9) Why are the Group VII elements (halogens) very strong oxidizing agents?
- 10) What is the relationship between the strength of an oxidizing agent and its corresponding reducing agent?
- 11) In the reaction,  $\text{O}_2 + 4\text{e}^- \rightarrow 2\text{O}^{2-}$ , is  $\text{O}_2$  oxidized or reduced?
- 12) In the reaction,  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ , which species is reduced?
- 13) In the reaction,  $\text{Mg} + \text{F}_2 \rightarrow \text{MgF}_2$ , which species is oxidized?
- 14) In a redox reaction,  $\text{MnO}_4^-$  is changed to  $\text{Mn}^{2+}$ . How many electrons must be lost or gained by Mn?
- 15) In a redox reaction,  $\text{MnO}_4^-$  is changed to  $\text{MnO}_4^{2-}$ . How many electrons must be lost or gained by Mn?
- 16) In a balanced redox equation, how does the total number of reactant molecules compare with the total number of product molecules?
- 17) What is the strongest reducing agent among the elements?
- 18) What is the strongest oxidizing agent among the elements?

**19) Balance the following redox reaction using the oxidation number method.**



**20) Balance the following redox reaction using the oxidation number method.**



## Solutions

- 1) Oxidation is a chemical reaction in which the atoms or ions of an element acquire a more positive oxidation state by losing electrons.
- 2) Reduction is a chemical reaction in which the atoms or ions of an element acquire a more negative oxidation state by gaining electrons.
- 3)  $\begin{matrix} +1 & -1 \\ \text{H}_2\text{O}_2 \end{matrix}$
- 4)  $\begin{matrix} +4 & -6 \\ & -2 \\ \text{SO}_3^{2-} \end{matrix}$
- 5) Only those reactions in which elements undergo a change in oxidation number (state).
- 6) (a) The oxidation number becomes more positive even though it may remain negative.  
(b) The oxidation number becomes more negative even though it may remain positive.
- 7) The oxidizing agent is reduced or acquires a more negative oxidation state and the reducing agent is oxidized or acquires a more positive oxidation state.
- 8) The relatively large atomic radii of the alkali metals results in a weak force of attraction between the positive nuclei and the one valence electron.
- 9) The relatively small atomic radii of the halogens results in a strong force of attraction between the positive nuclei and the seven valence electrons.
- 10) The stronger an oxidizing agent, the weaker its corresponding reducing agent.

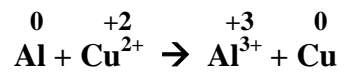
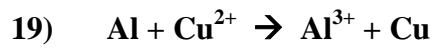
- 11)  $O_2$  is reduced because its oxidation state becomes more negative by changing from 0 to -2.
- 12)  $Cl_2$  is reduced because its oxidation state becomes more negative by changing from 0 to -1.
- 13) Mg is oxidized because its oxidation state becomes more positive by changing from 0 to +2.



16) As in all chemical reactions, there is no relationship that exists between the number of reactant and product molecules.

17) Lithium.

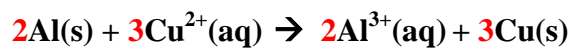
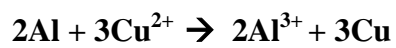
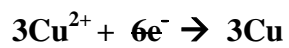
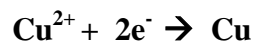
18) Fluorine.



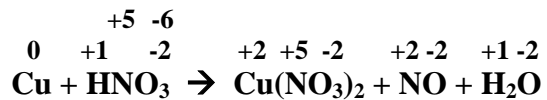
**oxidation:**



**reduction:**



20) copper + nitric acid → copper(II) nitrate + nitrogen monoxide + water



oxidation:



reduction:

