Chapter 17 Part 1

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Oxidation Numbers

- The oxidation number of an atom is the charge that an atom would have if the compounds was composed of ions.

Rules for assigning oxidation numbers

1. The sum of oxidation state for all atoms in a molecule or polyatomic ion equals the charge of the molecule or ion (indicated as a superscript)
2. The oxidation state of an atom in an elemental substance is zero
3. The oxidation state of a monatomic ion is equal to the ion's charge
4. Group 1 metals and silver have +1 oxidation states. Group 2 atoms and zinc have +2 oxidation states. Aluminum has a +3 oxidation state.
5. Hydrogen is +1 when combined with nonmetals and −1 when combined with metals
6. Oxygen is −2 is most compounds but is occasionally -1 in peroxides, O_2^{2-}.
7. Other atoms follow the previously discussed common charges

Oxidation Numbers

What is the oxidation state of bromine in BrO_4^-

Oxidation Numbers

What is the oxidation state of bromine in BrO_4^-

$$Br + 4(O) = -1$$

$$Br + 4(-2) = -1$$

$$Br - 8 = -1$$

$$Br = +7$$

Oxidation Numbers

Give the oxidation number of all of the atoms in the following compounds

A. N_2O_3

B. NO_3^-

C. $Mg(NO_3)_2$

D. H_2SO_4

E. $MnCl_2$

Oxidation Numbers

Give the oxidation number of all of the atoms in the following compounds

A. N_2O_3

   $N: +3 \quad O: -2$

B. NO_3^-

   $N: +5 \quad O: -2$

C. $Mg(NO_3)_2$

   $Mg: +2 \quad N: +5 \quad O: -2$

D. H_2SO_4

   $H: +1 \quad S: +6 \quad O: -2$

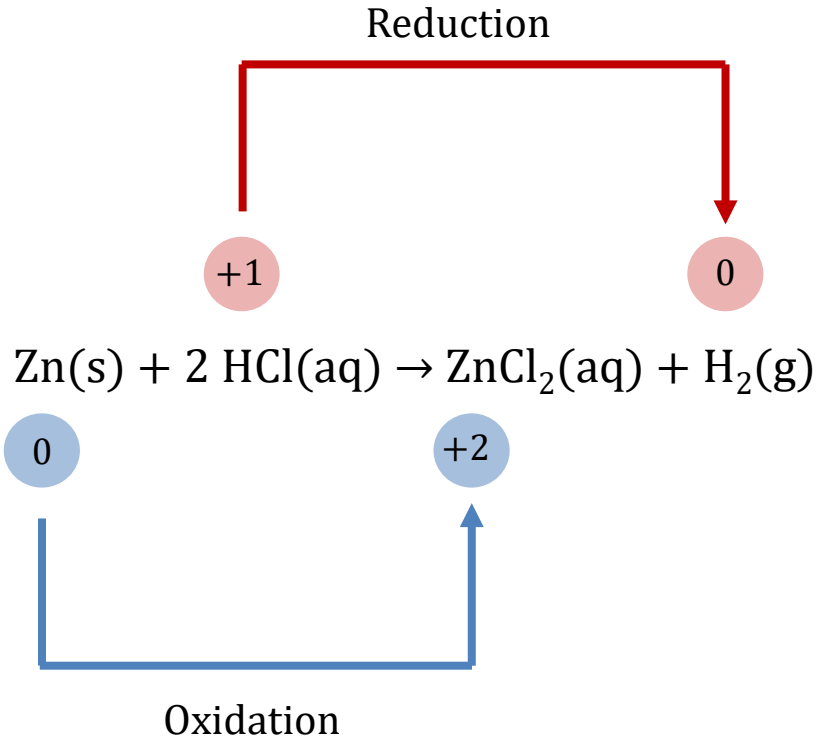
E. $MnCl_2$

   $Mn: +2 \quad Cl: -1$

Redox Reactions

- Redox reactions involve the transfer of electrons.
- One reactant loses electrons (oxidation), while another gains electrons (reduction).
- Oxidation occurs when the oxidation state of an element increases.
- Reduction occurs when the oxidation state decreases.
- This can be remembered with “LEO” says “GER”
  - Loosing electrons, oxidized. Gaining electrons, reduced

Redox Reactions



- Zinc
  - Oxidation state increases from 0 to +2
  - Zinc is oxidized
  - Zn(s) is reducing agent
- Hydrogen
  - Oxidation state decreases from +1 to 0
  - Hydrogen is reduced
  - HCl(aq) is oxidizing agent

Summary of Redox Terminology

Oxidation	Reduction
Increase in oxidation state	Decrease (reduction) in oxidation state
Loss of electrons	Gain of electrons
Reducing agent (whole substance)	Oxidizing agent (whole substance)

Redox Reactions

Identify whether the reaction is an oxidation reduction reaction. If so, identify what is oxidized, reduced, the oxidizing agent, and the reducing agent.

A. $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$

B. $MgI_2(aq) + 2\ AgNO_3(aq) \rightarrow 2\ AgI(s) + Mg(NO_3)_2(aq)$

C. $2\ C_8H_{18}(g) + 25\ O_2(g) \rightarrow 16\ CO_2(g) + 18\ H_2O(l)$

Redox Reactions

A. $\overset{0}{2\,H_2(g)} + \overset{0}{O_2(g)} \rightarrow \overset{+1\,-2}{2\,H_2O(g)}$ Redox

B. $MgI_2(aq) + 2\,AgNO_3(aq) \rightarrow 2\,AgI(s) + Mg(NO_3)_2(aq)$ Not Redox

C. $\overset{-2.25}{2\,C_8H_{18}(g)} + 25\,\overset{0}{O_2(g)} \rightarrow \overset{+4}{16\,CO_2(g)} + \overset{-2}{18\,H_2O(l)}$ Redox

Letter	Oxidized	Reduced	O. Agent	R. Agent
A	H	O	O_2	H_2
C	C	O	O_2	C_8H_{18}

Oxidizing Agents

Identify the oxidizing agent in the reaction below

$$Zn(s) + CuCl_2(aq) \rightarrow ZnCl_2(aq) + Cu(s)$$

A. Zn
B. $CuCl_2$
C. Cu
D. Cl
E. $ZnCl_2$

Oxidizing Agents

Identify the oxidizing agent in the reaction below

$$Zn(s) + CuCl_2(aq) \rightarrow ZnCl_2(aq) + Cu(s)$$

A. Zn
B. $CuCl_2$
C. Cu
D. Cl
E. $ZnCl_2$

The correct answer is B

Reducing Agents

Identify the reducing agent in the reaction below.

$$Al(s) + 3\ CuBr(aq) \rightarrow AlBr_3(aq) + Cu(s)$$

A. Al
B. Cu
C. Br
D. CuBr
E. $AlBr_3$

Reducing Agents

Identify the reducing agent in the reaction below.

$$Al(s) + 3\ CuBr(aq) \rightarrow AlBr_3(aq) + Cu(s)$$

A. Al
B. Cu
C. Br
D. CuBr
E. $AlBr_3$

The correct answer is A