

Redox Reactions

An introduction to Electrochemistry

Total Ionic Equation

* Represent every ion in an equation individually.

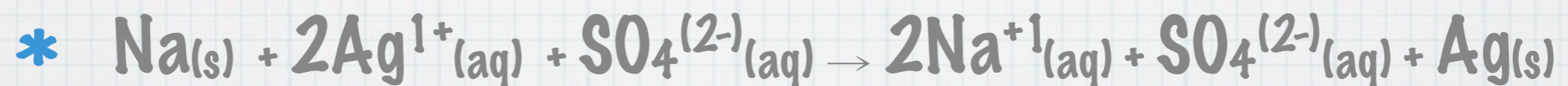
* Example: $\text{Na}_{(s)} + \text{Ag}_2\text{SO}_{4(aq)} \rightarrow \text{Na}_2\text{SO}_{4(aq)} + \text{Ag}_{(s)}$

* Total Ionic Equation:

* $\text{Na}_{(s)} + 2\text{Ag}^{1+}_{(aq)} + \text{SO}_4^{(2-)}_{(aq)} \rightarrow 2\text{Na}^{+1}_{(aq)} + \text{SO}_4^{(2-)}_{(aq)} + \text{Ag}_{(s)}$

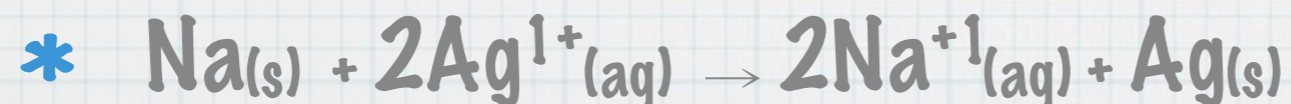
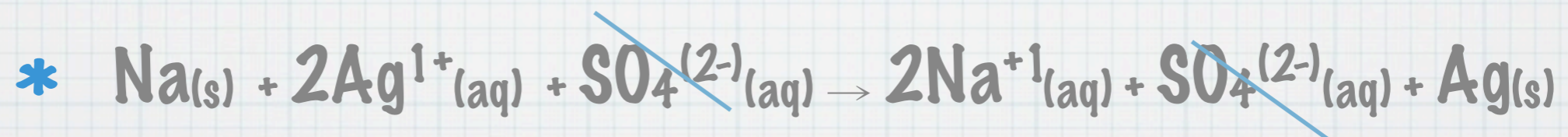
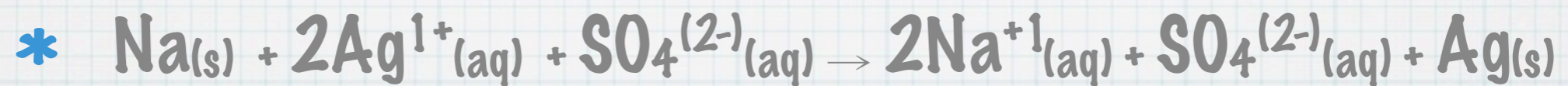
Net Ionic Equation

* Only represent the ions that change from one side to another.



Net Ionic Equation

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Reduction

- * A process in which chemical entities gain electrons
- * In the above reaction, Ag^{1+} becomes Ag , a gain of one electron

Oxidation

- * A process in which chemical entities lose electrons.
- * In the above reaction Na becomes Na^{1+} , a loss of one electron

Redox Reactions

- * A reaction in which one reactant is oxidized and the other reactant is reduced.

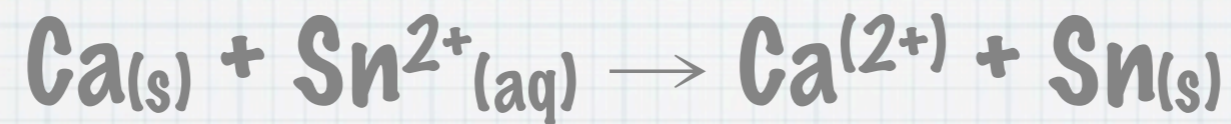


LEO the lion says GER

Loss of Electrons means Oxidation
Gain of Electrons means Reduction

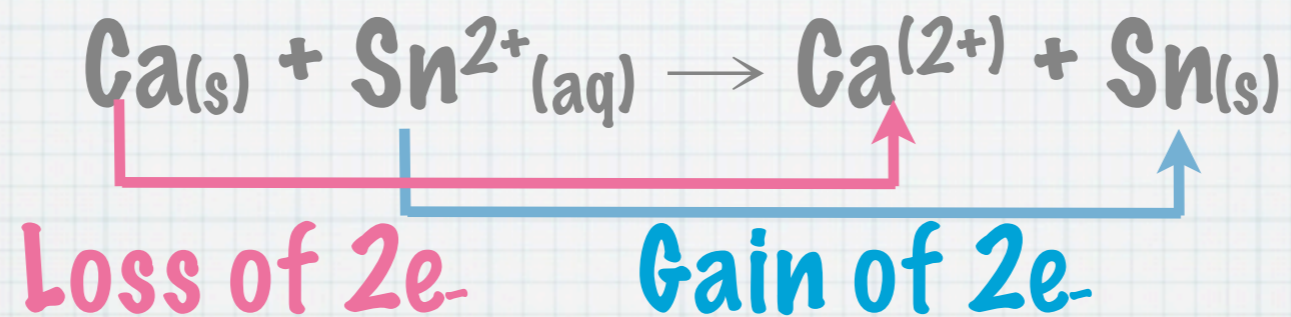
Redox Reactions of Ionic Compounds

- * Identify the reactants that are oxidized and reduced



Redox Reactions of Ionic Compounds

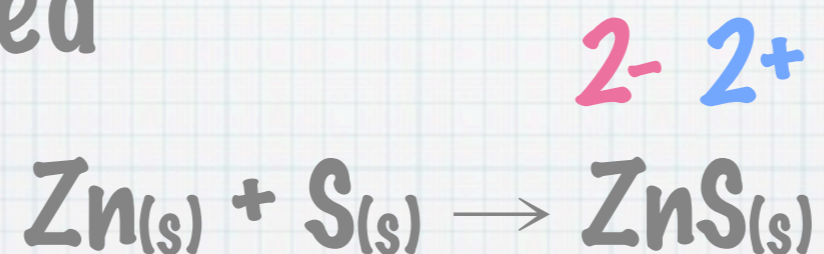
- * Identify the reactants that are oxidized and reduced



Therefore, calcium is being oxidized and tin is being reduced.

Redox Reactions of Ionic Compounds

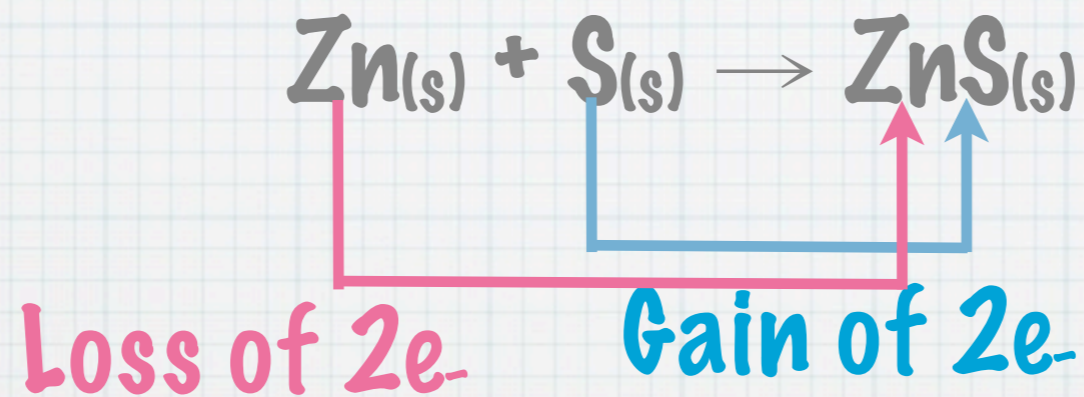
- * Identify the reactants that are oxidized and reduced



Therefore, calcium is being oxidized and tin is being reduced.

Redox Reactions of Ionic Compounds

- * Identify the reactants that are oxidized and reduced



Therefore, zinc is being oxidized and sulfur is being reduced.

Redox Reactions

Part II: Determining oxidation numbers

Redox Reactions of Nonmetals

- * Unlike ionic compounds, covalent compounds share electrons rather than gain or lose.
- * We must use oxidation numbers to show electron exchange.

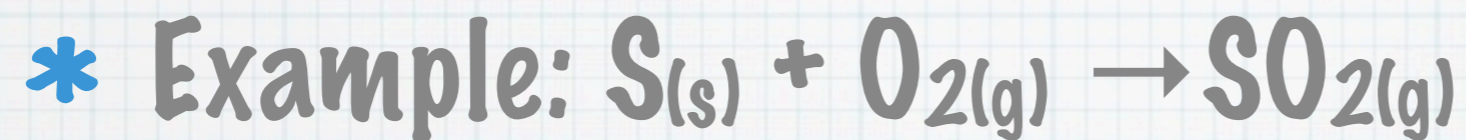
Calculating Oxidation Numbers

- * Let's look at oxygen
- * Must gain 2 electrons ($2e^-$)
- * We assign oxygen an oxidation number of two.

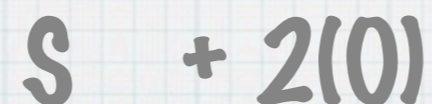
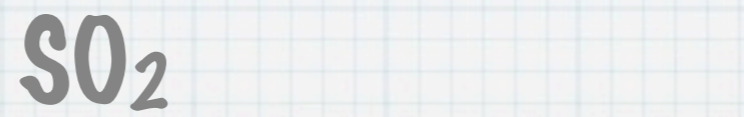
Using Oxidation Numbers

- * We know that the sum of all oxidation numbers in a neutral molecule must be zero.

Using Oxidation Numbers

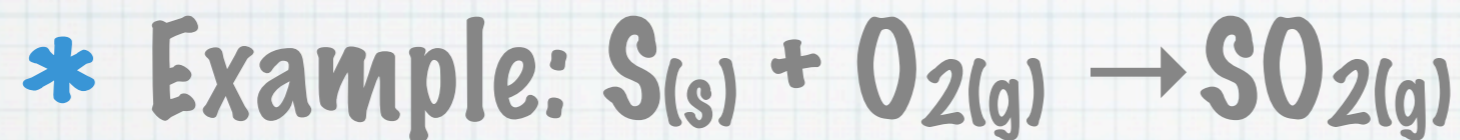


* Determine the oxidation number of S in $SO_{2(g)}$

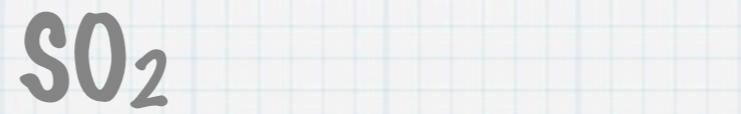


We know that the oxidation number of oxygen is 2

Using Oxidation Numbers



* Determine the oxidation number of S in $SO_{2(g)}$



$$S + 2(-2) = 0$$

$$S + (-4) = 0$$

$$S = (+4)$$

Therefore the oxidation number of sulfur in SO_2 is +4.

Using Oxidation Numbers

- * Determine the oxidation number of N in $\text{KNO}_3(\text{s})$

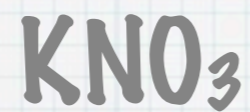


$$\text{K} + \text{N} + 3(\text{O}) = 0$$

We know that the oxidation number of oxygen is -2 and the oxidation number for K is +1

Using Oxidation Numbers

- * Determine the oxidation number of N in $\text{KNO}_3(\text{s})$



$$\text{K} + \text{N} + 3(\text{O}) = 0$$

$$(+1) + (\text{N}) + 3(-2) = 0$$

$$1 + \text{N} - 6 = 0$$

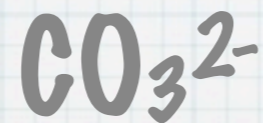
$$-5 + \text{N} = 0$$

$$\text{N} = +5$$

Therefore the oxidation number of nitrogen in KNO_3 is +5.

Using Oxidation Numbers

- * Determine the oxidation number of C in $\text{CO}_3^{2-}(\text{g})$

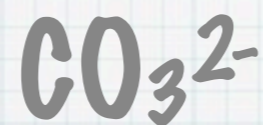
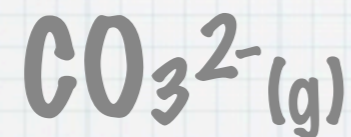


$$\text{C} + 3(\text{O}) = -2$$

We know that the oxidation number of oxygen is -2

Using Oxidation Numbers

- * Determine the oxidation number of C in



$$\text{C} + 3(0) = -2$$

$$\text{C} + 3(-2) = -2$$

$$\text{C} - 6 = -2$$

$$\text{C} = +4$$

Therefore the oxidation number of C in CO_3^{2-} is +4.

Rules to Assigning Oxidation Numbers

- * The oxidation number of an ion is the charge of that ion.
- * The sum of all oxidation numbers in compound is always zero unless the compound itself carries a charge.