**Writing and Balancing Half Reactions**

Identifying if a reaction is a redox reaction

Are electrons transferred? To answer this question you'll have to write down the chemical equation for the process and assign oxidation numbers to the atoms in all of the reactants and products. If the oxidation numbers for any of the atoms in the reactants are different from the oxidation number for the same atoms on the product side, electron transfer must have occurred, and you have a redox reaction. Based on the reading passage above, write how you can tell if a reaction is a redox reaction.

|  |  |
| --- | --- |
| You know it’s redox when… | You know it’s NOT redox when… |

Half Reaction

* Half reaction shows the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a redox reaction
* One half reaction shows \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; the other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example of a Reduction Half Reaction

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Electrons on the left side, gained in the reaction

Example of an Oxidation Half Reaction

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Electrons are the right hand side, loss of electrons in the reaction
* Always \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the side the reaction that has the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Complete the Incomplete Half-Reactions – rewrite the equation and place the correct number of electrons on the appropriate side

* I2 → 2I– \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Cr2+ → Cr3+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Sr → Sr2+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Following the law of conservation

* Half reactions follow:
  + Law of conservation of mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on both sides of the reaction
  + Conservation of charge: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on both sides of the equation (# of electrons lost = # electrons gained)

Rules for setting up half reactions

* Assign oxidation numbers

Mg + ZnCl2 🡪 MgCl2 + Zn

* Identify oxidation and reduction
  + \_\_\_\_\_\_\_\_\_ is oxidized because electrons were lost and the oxidation number increased
  + \_\_\_\_\_\_\_\_\_ is reduced because electrons were gained and the oxidation number decreased
* Write the oxidation and reduction half reactions

Mg + ZnCl2 🡪 MgCl2 + Zn

* Reduction Half Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Oxidation Half Reactions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Balance masses (change coefficients) and balance charge – multiply each half reaction to have the same number of electrons

Mg + ZnCl2 🡪 MgCl2 + Zn

* + Reduction:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Oxidation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Practice**:** For each reaction, write the oxidation and reduction half reactions. Then balance out the equations.

|  |  |
| --- | --- |
| Li + Ca+2 🡪 Li+1 + Ca | Mn + Cu+2 🡪 Mn+4 + Cu |
| Ni + Fe+3 🡪 Ni+3 + Fe | Zn + Cr3+ 🡪 Zn2+ + Cr |