

# **Balancing Oxidation-Reduction Equations**

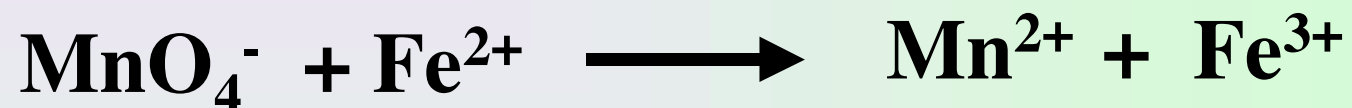
## **Half-Reaction Method in Acid**

- 1. Write the unbalanced equation in ionic form.**
- 2. Separate the equation into two half-reactions.**
- 3. Balance each half reaction (except for O and H).**
- 4. In acid solution, balance O by adding  $\text{H}_2\text{O}$  and H by adding  $\text{H}^+$**
- 5. Balance the charges by adding electrons.**
- 6. Add the half reactions**
- 7. Check to make sure atoms and charges are balanced**

# Example

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**Balance the following equation for the reaction in acid solution. \***

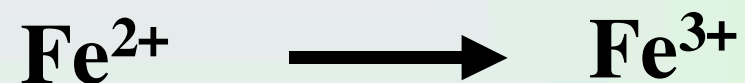


**\*All species are (aq)**

**1. Write the unbalanced equation in ionic form.**

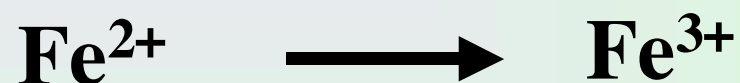


**2. Separate the equation into two half-reactions**



**3. Balance each half reaction (except for O and H).**

**4. In acid solution, balance O by adding H<sub>2</sub>O and H by adding H<sup>+</sup>**



## 5. Balance the charges by adding electrons.

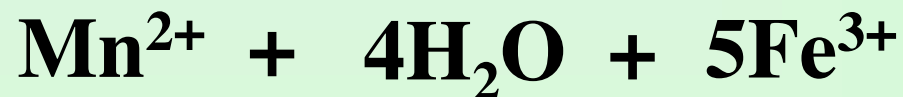
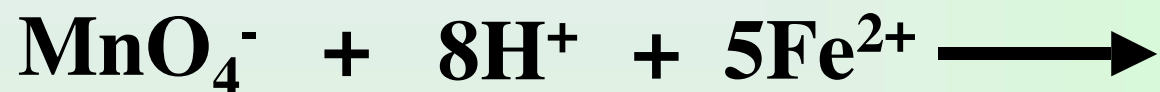
You need the same number of electrons on both sides of the equation.



**5. Balance the charges by adding electrons.**



## 6. Add the half reactions



**This is the balanced equation**

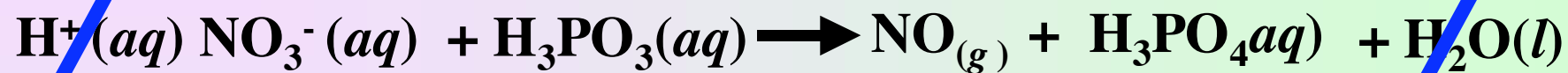
# Example

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**Balance the following equation for the reaction in acid solution. \***



**1. Write the unbalanced equation in ionic form.**

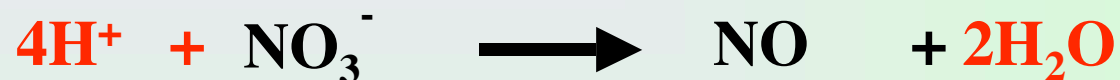


**2. Separate the equation into two half-reactions**



**3. Balance each half reaction (except for O and H).**

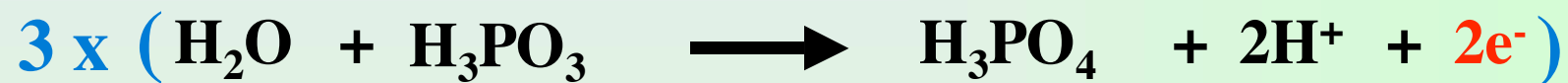
**4. In acid solution, balance O by adding H<sub>2</sub>O and H by adding H<sup>+</sup>**



## 5. Balance the charges by adding electrons.



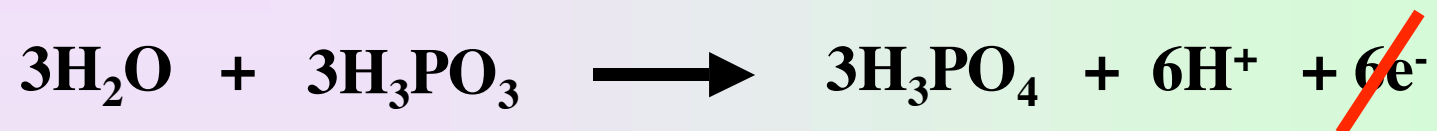
**5. Balance the charges by adding electrons.**



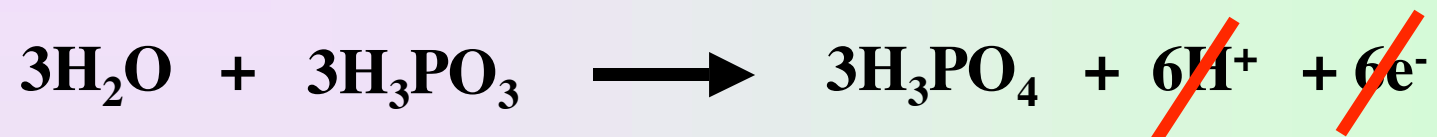
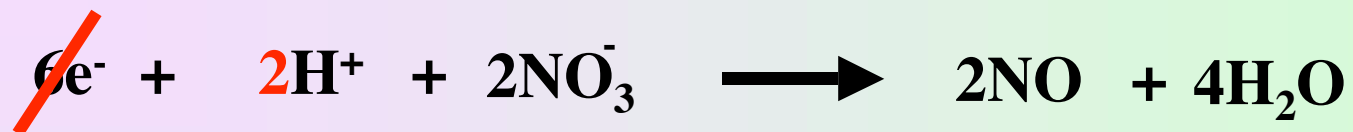
**5. Balance the charges by adding electrons.**



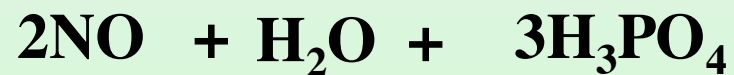
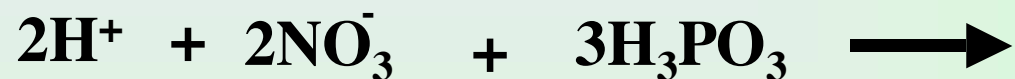
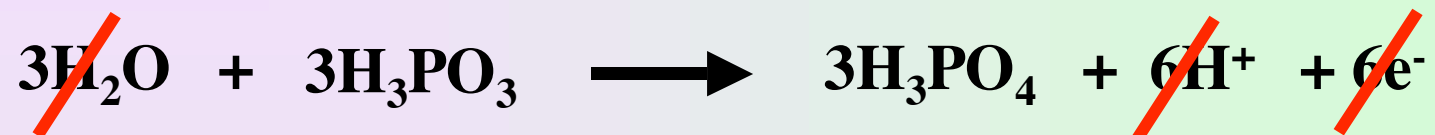
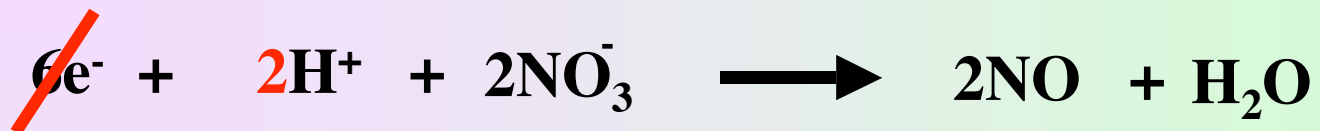
## 6. Add the half reactions



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**This is the balanced equation**

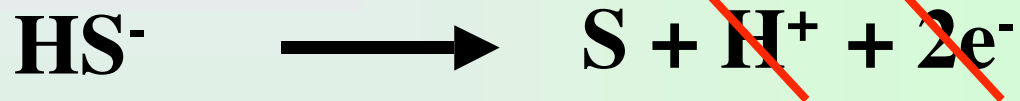
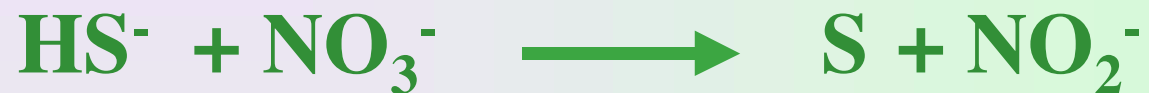
## Half-Reaction Method in Base

- 1. Use the half-reaction method as specified for acidic solutions to obtain the final balanced equation *as if  $H^+$  ions were present.***
- 2. Add the number of  $OH^-$  ions to both sides of the equation to turn the remaining  $H^+$  ions to  $H_2O$**
- 3. Eliminate waters that appear on both sides of the equation.**

# Example

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**Balance the following equation for the reaction in basic solution. \***

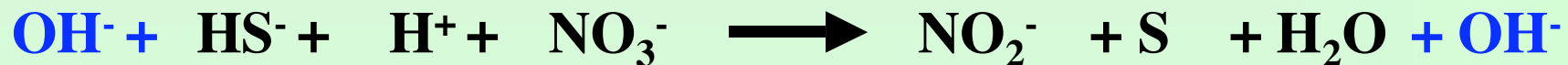
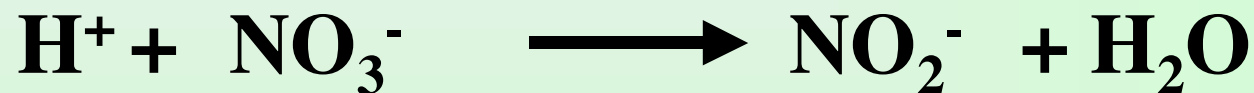
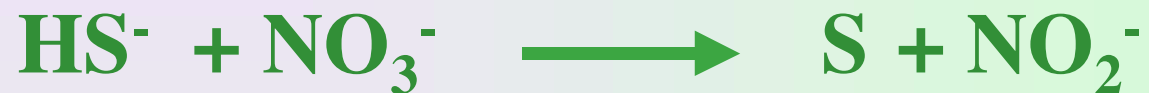


**\*All species are (aq)**

# Example

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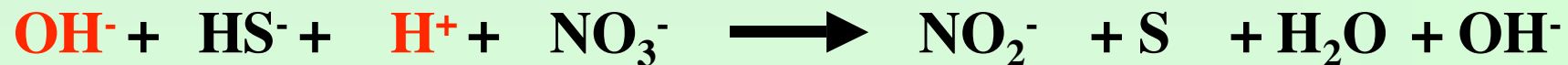
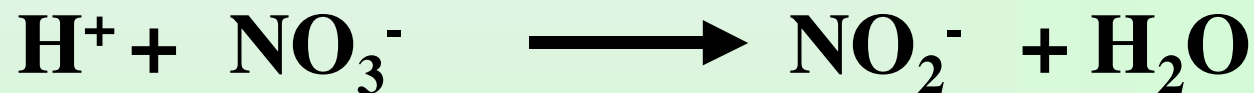
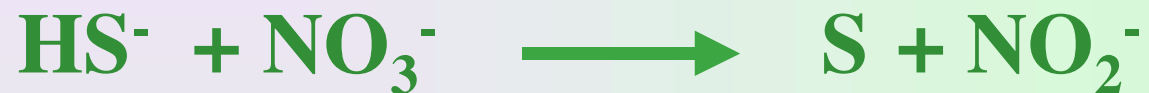
Balance the following equation for the reaction in basic solution. \*



# Example

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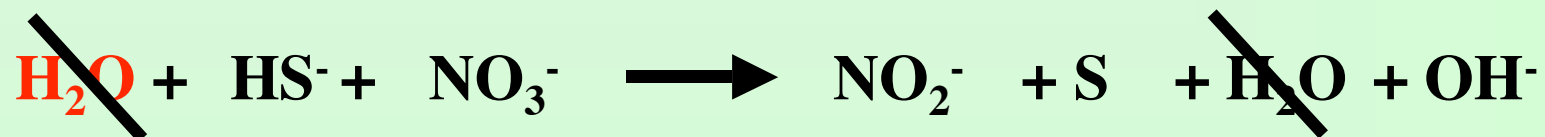
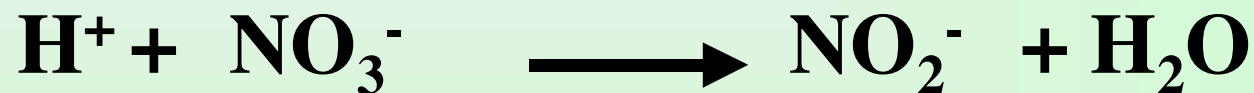
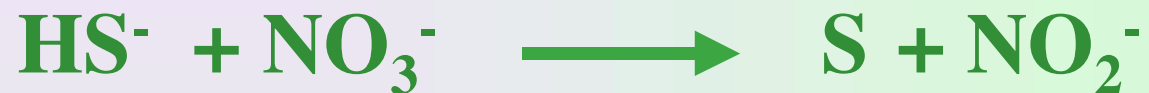
Balance the following equation for the reaction in basic solution. \*



# Example

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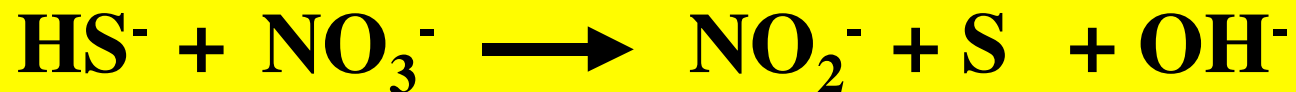
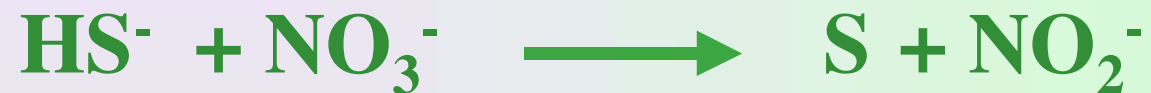
Balance the following equation for the reaction in basic solution. \*



# Example

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**Balance the following equation for the reaction in basic solution. \***



# Example

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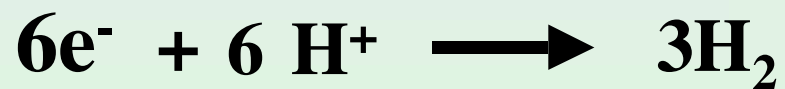
**Balance the following equation for the reaction in acid solution. \***



# Example

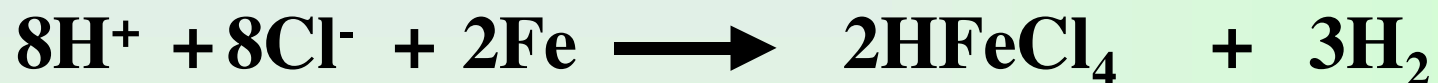
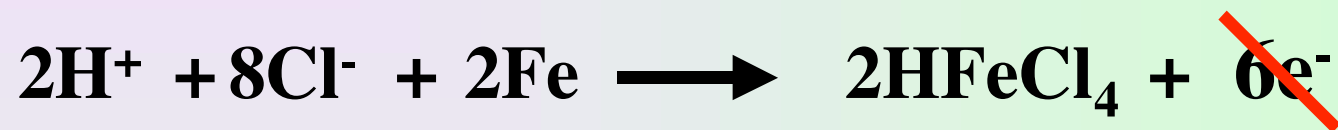
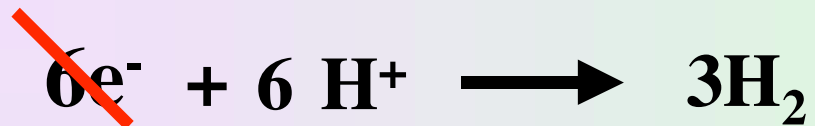
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**Balance the following equation for the reaction in acid solution. \***



# Example

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or

