

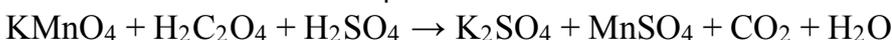
# Balancing KMnO<sub>4</sub> Reaction Oxalic.



To balance the reaction of KMnO<sub>4</sub> with oxalic acid (H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>) in sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) using the oxidation number method, follow these steps:

## Step 1: Write the Unbalanced Reaction

The unbalanced chemical equation for the reaction in acidic medium is:



## Step 2: Identify Oxidation States and Changes

- **Manganese (Mn)** in KMnO<sub>4</sub> is reduced from +7 to +2 in MnSO<sub>4</sub>.
- **Carbon (C)** in oxalic acid is oxidized from +3 in H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> to +4 in CO<sub>2</sub>.

## Step 3: Balance Atoms of Elements Undergoing Oxidation and Reduction

- Mn is balanced as is with one Mn on both sides.
- Each molecule of H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> yields two CO<sub>2</sub> molecules, indicating two C atoms are oxidized per molecule of oxalic acid.

## Step 4: Balance the Oxygen Atoms

- KMnO<sub>4</sub> has 4 O atoms and H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> has 4 O atoms per molecule, oxidizing to 2 CO<sub>2</sub> molecules (total 4 O atoms). Additional oxygens in products are balanced using water molecules.

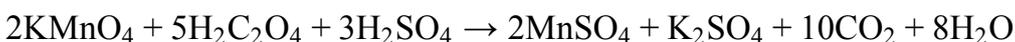
## Step 5: Balance Hydrogen Atoms

- Use H<sup>+</sup> ions from H<sub>2</sub>SO<sub>4</sub> or water molecules to balance the hydrogen atoms.

## Step 6: Balance Charge with Electrons

- Oxidation:  $\text{C}^{+3} \rightarrow \text{C}^{+4} + e^-$
- Reduction:  $\text{Mn}^{+7} + 5e^- \rightarrow \text{Mn}^{+2}$
- To equalize the electron exchange, multiply the oxidation half-reaction by 5 and the reduction half-reaction by 2, as 10 electrons are transferred.

## Balanced Equation:



This method ensures that the number of atoms and the charge are balanced on both sides of the reaction equation.



**You**

10 Redox reactions to practice balancing by oxidation number method. Get the balanced reactions finally in a separate page.



**SaitechAI**

Here are 10 redox reactions that you can practice balancing using the oxidation number method. I will provide the unbalanced equations first, followed by their balanced forms:

### Unbalanced Reactions

1.  $\text{Fe}^{2+} + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Fe}^{3+} + \text{Cr}^{3+}$  (in acidic solution)
2.  $\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} \rightarrow \text{Mn}^{2+} + \text{CO}_2$  (in acidic solution)
3.  $\text{Cl}_2 + \text{OH}^- \rightarrow \text{Cl}^- + \text{ClO}_3^-$  (in basic solution)
4.  $\text{H}_2\text{O}_2 + \text{MnO}_4^- \rightarrow \text{O}_2 + \text{Mn}^{2+}$  (in acidic solution)
5.  $\text{I}^- + \text{MnO}_4^- \rightarrow \text{I}_2 + \text{Mn}^{2+}$  (in acidic solution)
6.  $\text{Sn}^{2+} + \text{Hg}^{2+} \rightarrow \text{Sn}^{4+} + \text{Hg}$
7.  $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}^{2+} + \text{NO} + \text{H}_2\text{O}$
8.  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{Zn}^{2+} + \text{SO}_2 + \text{H}_2\text{O}$
9.  $\text{Na}_2\text{S}_2\text{O}_3 + \text{I}_2 \rightarrow \text{NaI} + \text{Na}_2\text{S}_4\text{O}_6$
10.  $\text{SO}_3^{2-} + \text{MnO}_4^- \rightarrow \text{SO}_4^{2-} + \text{Mn}^{2+}$  (in acidic solution)

### Balanced Reactions

1.  $6\text{Fe}^{2+} + \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ \rightarrow 6\text{Fe}^{3+} + 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
2.  $2\text{MnO}_4^- + 5\text{C}_2\text{O}_4^{2-} + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$
3.  $3\text{Cl}_2 + 6\text{OH}^- \rightarrow 5\text{Cl}^- + \text{ClO}_3^- + 3\text{H}_2\text{O}$
4.  $5\text{H}_2\text{O}_2 + 2\text{MnO}_4^- + 6\text{H}^+ \rightarrow 5\text{O}_2 + 2\text{Mn}^{2+} + 8\text{H}_2\text{O}$
5.  $2\text{MnO}_4^- + 10\text{I}^- + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 5\text{I}_2 + 8\text{H}_2\text{O}$
6.  $\text{Sn}^{2+} + 2\text{Hg}^{2+} \rightarrow \text{Sn}^{4+} + 2\text{Hg}$
7.  $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}^{2+} + 2\text{NO}_2 + 2\text{H}_2\text{O}$
8.  $\text{Zn} + 2\text{H}_2\text{SO}_4 \rightarrow \text{Zn}^{2+} + \text{SO}_2 + 2\text{H}_2\text{O}$
9.  $\text{Na}_2\text{S}_2\text{O}_3 + \text{I}_2 \rightarrow 2\text{NaI} + \text{Na}_2\text{S}_4\text{O}_6$
10.  $5\text{SO}_3^{2-} + 2\text{MnO}_4^- + 6\text{H}^+ \rightarrow 5\text{SO}_4^{2-} + 2\text{Mn}^{2+} + 3\text{H}_2\text{O}$

These balanced reactions should provide good practice for mastering the oxidation number method. If you want to have these reactions in a separate document, I can prepare that for you.