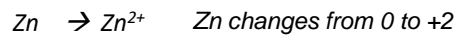


Balancing redox equations

Writing half equations

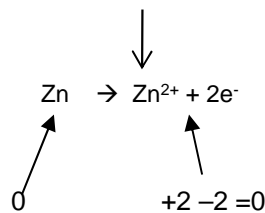
1. Work out oxidation numbers for element being oxidised/ reduced



2. Add electrons equal to the change in oxidation number

For reduction add e's to reactants

For oxidation add e's to products



3. check to see that the sum of the charges on the reactant side equals the sum of the charges on the product side

More complex half-equations

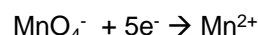
If the substance that is being oxidised or reduced contains a varying amount of O (eg $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$) then the half equations are balanced by adding H^+ , OH^- ions and H_2O .

In acidic conditions use H^+ and H_2O

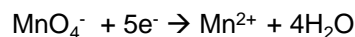
Example: Write the half equation for the change $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$

1. Balance the change in O.N. with electrons

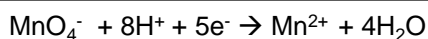
Mn changes from +7 to +2
Add 5 electrons to reactants



2. Add H_2O in products to balance O's in MnO_4^-



3. Add H^+ in reactants to balance H's in H_2O



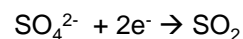
4. check to see that the sum of the charges on the reactant side equals the sum of the charges on the product side

$$-1 + 8 - 5 = +2 \qquad \qquad +2$$

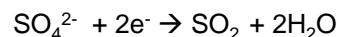
Example: Write the half equation for the change $\text{SO}_4^{2-} \rightarrow \text{SO}_2$

1. Balance the change in O.N. with electrons

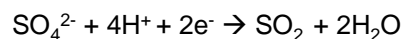
S changes from +6 to +4
Add 2 electrons to reactants



2. Add H_2O in products to balance O's in SO_4^{2-}



3. Add H^+ in reactants to balance H's in H_2O



4. check to see that the sum of the charges on the reactant side equals the sum of the charges on the product side

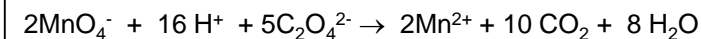
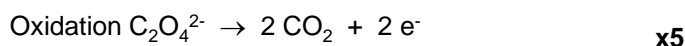
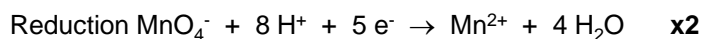
$$-4 + 4 = 0 \qquad \qquad 0$$

Combining half-equations

To make a full redox equation combine a reduction half equation with a oxidation half equation

To combine two half equations there must be equal numbers of electrons in the two half equations so that the electrons cancel out

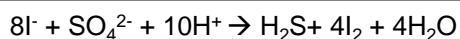
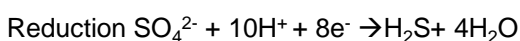
Example 1



Multiply the half equations to get equal electrons

Add half equations together and cancel electrons

Example 2



Multiply the half equations to get equal electrons

Add half equations together and cancel electrons