

Redox Reactions

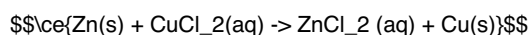
Definitions of Redox

| Type | Definition of Oxidation | Definition of Reduction |
|------------------|-----------------------------|-----------------------------|
| Oxygen | Gain of oxygen | Loss of oxygen |
| Hydrogen | Loss of hydrogen | Gain of hydrogen |
| Electrons | Loss of electrons | Gain of electrons |
| Oxidation States | Increase in Oxidation State | Decrease in Oxidation State |

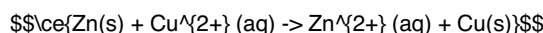
Transfer of Electrons - Definition

In the following redox reaction, **zinc metal is oxidised while copper(II) ions are reduced.**

Consider the following reaction:



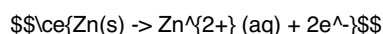
Ionic equation:



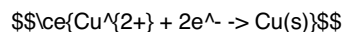
An ionic half equation shows which reactant particles gain or lose electrons to form products. To construct ionic half equations, follow these steps:

1. **Isolate reactant and product of the same element** into a single ionic half equation.
2. **Add coefficients** to balance the number of elements on the reactant and product sides of the ionic half equation
3. **Add electrons** to the ionic half equations to balance the charges on the reactant and product sides. Note that electrons are negatively charged.
4. **Write state symbols** for all reactant and product particles.

Oxidation ionic half equation involving zinc:



Reduction ionic half equation involving copper:



| Reactant Particle | Is reactant particle oxidised/reduced? | Are electrons on reactant or product side? | Did reactant particle undergo gain or loss of electrons? |
|-------------------|--|--|--|
| Zn | Oxidised | product | loss |
| Cu^{2+} | Reduced | reactant | gain |

Using ideas about electron transfer, explain why the reaction between zinc metal and aqueous copper(II) chloride is a redox reaction.

- Zinc atom loses electrons to form Zn^{2+} ions and copper(II) ions gained electrons to form copper atoms. Hence, zinc atom is oxidised and copper(II) ions are reduced simultaneously.

Based on the definitions of oxidation and reduction written in (iii), deduce if oxidation and reduction can take place independently of one another. Explain your answer.

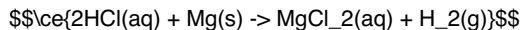
- Oxidation and reduction cannot take place independently of one another as electrons that are lost by a particle is gained by another particle.

From your answer in (v), briefly define a redox reaction.

- A redox reaction is a chemical reaction in which reduction and oxidation occur at the same time.

Examples

By constructing ionic and ionic half equations for the following reactions, use ideas about electron transfer to explain why they are redox reactions.



Ionic equation: $\text{2H}^+\text{(aq)} + \text{Mg(s)} \rightarrow \text{Mg}^{2+}\text{(aq)} + \text{H}_2\text{(g)}$

Ionic half equations:

Oxidation: $\text{Mg(s)} \rightarrow \text{Mg}^{2+}\text{(aq)} + 2\text{e}^-$

Reduction: $\text{2H}^+\text{(aq)} + 2\text{e}^- \rightarrow \text{H}_2\text{(g)}$

Organic Chemistry

Fuels and Crude Oil (Biofuels)

Fractions

- Petroleum Gas
- Petrol
- Naphtha
- Kerosene
- Diesel oil
- Lubricating oil
- Bitumen

The lower the fraction collected, the higher the boiling point of the fraction.

- ii. The diagram below shows the fractionating column where crude oil is separated into its various fractions. Fill in the blanks with the names of the fractions.

