



Batteries

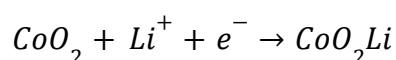
Calculation and Discussion Exercise (approximately 20 minutes)

Task Description

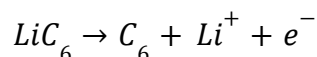
The cards related to electric cars and diesel cars demonstrate that electric cars have a significantly smaller climate impact compared to diesel cars (especially when the electric cars are powered by a substantial amount of renewable electricity). However, electric cars also come with certain drawbacks. In this task, we will take a closer look at how electric car batteries work and explore both their advantages and disadvantages.

Calculation Exercise: In the electric cars produced today, such as Tesla, lithium-ion batteries are primarily used due to their high energy density. Similar to many other batteries, lithium-ion batteries consist of a cathode and an anode, and with some simplifications, it can be stated that the following reactions occur in the battery:

Anode Reaction:



Cathode Reaction:



The electrode potential for the cathode reaction is +0.84 V, and the electrode potential for the anode reaction is -2.84 V. Calculate the total voltage that can be obtained from a battery cell.

Discussion Exercise: The shift from gasoline and diesel cars to electric cars mostly benefits the climate. However, there are still several challenges, difficulties, and limitations related to batteries and their use. What are these challenges? How can they be managed or resolved? Take some time to think individually first, and then discuss in groups. Consider not only climate and other environmental aspects but also social, economic, and practical aspects.

Suggestion Solutions

Calculation Exercise:

The voltage is determined by calculating the difference (i.e., the subtraction) between the potential of the anode reaction and the cathode reaction, which is: $+0.84 - (-2.84) = 3.68 \text{ V}$.

Discussion Exercise:

There's a lot to discuss here, and the points below are just some suggestions:

- Sustainability challenges related to battery production, such as the mining of cobalt and other materials.
- The use of child labor in mines in developing countries.
- The climate impact of the electricity used to charge the batteries (depends on the extent to which the electricity is generated from fossil fuels).
- The use of toxic chemicals in battery manufacturing, which can have a negative impact on the local environment and workers' health.
- Limited energy storage capacity and lifespan of batteries.
- Challenges related to battery recycling.
- Limited charging infrastructure.

Expected Learning Outcomes

Gain insight into electric car batteries, their advantages and disadvantages, and explore sustainability challenges in battery production.