battery structure : anode made of graphite, cathode is made of metal oxide

what happens in the anode : oxidation

what happens in the cathode : reduction

The "rocking-chair" mechanism in a lithium-ion battery refers to the movement of lithium ions back and forth between the cathode and anode during charging and discharging, without the need for external electron transfer.

The carbon component provides good electrical conductivity and helps to buffer the volume changes of the silicon during cycling, while the silicon component contributes to high capacity.

C-rate is a measure of the rate at which a battery is charged or discharged relative to its nominal capacity

Ampere-hours (Ah) is a unit of electrical charge commonly used to express the capacity of a battery.

When a Lithium-ion battery is charged, lithium ions are driven from the cathode (positive electrode) to the anode (negative electrode) through the electrolyte.

During discharge, the process is reversed. The anode releases the previously absorbed lithium ions, which move through the electrolyte to the cathode

Lithium-ion battery fire accidents are difficult to control because they are caused by a chain reaction involving flammable electrolyte, oxygen, and high temperatures, which can be difficult to extinguish once initiated.

Electro-neutrality refers to the condition in which an electrochemical system has a balanced distribution of positively charged and negatively charged species, so that the net charge is zero. This condition is necessary for the system to be stable and in equilibrium.

In the chemical reactions of a salt bridge, Zn gets oxidized and loses electrons to form Zn2+ ions, while Cu2+ ions in the other half-cell gets reduced by gaining electrons to form Cu metal. Therefore, Zn gets oxidized, and Cu gets reduced.

I'm sorry, but your question is incomplete. To calculate the standard cell voltage, we need to know the half-reactions involved in the cell and their standard reduction potentials. Could you please provide more information about the specific cell you are referring to?

During charging of a lithium-ion battery, lithium ions from the electrolyte combine with oxygen ions in the metal oxide cathode, causing the cathode to become reduced and accept electrons

from the lithium ions. Meanwhile, at the anode, the lithium atoms release electrons and become lithium ions that move towards the electrolyte.

However, the overall electroneutrality of the system is still preserved because the total number of positive charges in the system remains equal to the total number of negative charges.

The first law of thermodynamics in electrochemistry, also known as the law of conservation of energy, states that energy cannot be created or destroyed, only transferred or converted from one form to another. In electrochemistry, this law is expressed in terms of the energy changes that occur during a redox reaction in an electrochemical cell.

The equation that expresses the first law of thermodynamics in electrochemistry is:

$\Delta U = q + w = 0$

In a redox reaction, electrons are transferred from one species to another. The species that loses electrons is oxidized

Electrochemistry plays an important role in the reduction of carbon dioxide (CO_2) by providing a way to convert CO_2 into useful chemicals or fuels using renewable energy sources. This process is known as electrochemical CO_2 reduction, or sometimes referred to as artificial photosynthesis.

Climate change is primarily caused by the increase in atmospheric concentrations of greenhouse gases, such as carbon dioxide, that trap heat in the Earth's atmosphere and lead to rising temperatures. The reduction of global carbon dioxide emissions is a critical component of efforts to mitigate climate change.

In electrochemistry, the enthalpy change of a reaction is related to the electrical work done by the system. This relationship is given by the following equation:

$\Delta H = -nFE$

Silver (Ag) has a higher ionization energy than Cadmium (Cd) because Ag has a stronger attraction between its positively charged nucleus and negatively charged electrons, which makes it harder to remove an electron from an Ag atom than from a Cd atom.

In the process of the ionization of Zn metal in Copper Sulfate solution, the surface electrons of the Zn metal are indeed removed, but they are gained by the Cu^{2+} ions in the solution, which reduces them to Cu metal. This transfer of electrons from Zn to Cu^{2+} ions maintains the overall electro-neutrality of the system.

The second law of thermodynamics states that in any energy transfer or transformation, some energy will be lost or dissipated as heat, and no process can be 100% efficient. Therefore, a

perpetual motion machine, which would create energy without any input or lose energy, would violate this law and cannot exist in reality.

The Gibbs free energy is a thermodynamic quantity that predicts the spontaneity and extent of a chemical or physical process based on its enthalpy and entropy changes.

The equation for Gibbs free energy (ΔG) is $\Delta G = \Delta H - T\Delta S$, where ΔH is the enthalpy change, T is the temperature in Kelvin, and ΔS is the entropy change.

The sign of Gibbs free energy (ΔG) for a non-spontaneous reaction is positive ($\Delta G > 0$), while the sign of enthalpy (ΔH) is also positive ($\Delta H > 0$) and the sign of entropy (ΔS) is negative ($\Delta S < 0$).

Batteries store energy while fuel cells produce energy from an external supply of fuel and oxygen.