

## Cells and batteries notes

An electrochemical cell typically consists of two electrodes (an anode and a cathode) and an electrolyte, which allows the movement of ions. The anode is where oxidation occurs, while reduction occurs at the cathode.

Galvanic cells (or voltaic cells) convert chemical energy into electrical energy spontaneously through redox reactions, while electrolytic cells require an external electrical source to drive non-spontaneous reactions.

Electrolytes are substances that dissociate into ions when dissolved in a solvent, allowing for the conduction of electricity through the solution. They are essential for facilitating the flow of ions between the anode and cathode in an electrochemical cell.

**ELECTROCHEMISTRY** Electrochemistry is the branch of the science that deals with the transformation of chemical energy into electrical energy and vice versa or it deals with the relationship between electrical and chemical energy produced in a redox reaction.

In the above reaction, Zn displaces copper ions ( $\text{Cu}^{2+}$ ) from aqueous solution. This reaction can be achieved very easily in practice. Put a Zn rod into a solution of  $\text{CuSO}_4$  (containing  $\text{Cu}^{2+}$  ions). It is observed that the blue color of  $\text{CuSO}_4$  solution disappears after some time. In this situation, Zn loses 2 electrons per atom, and  $\text{Cu}^{2+}$  ions in the solution accept them.  $\text{Cu}^{2+}$  ions from the solution in this manner are deposited in the form of solid Cu and Zn goes into the solution as  $\text{Zn}^{2+}$  (colorless). The reaction can well be understood in terms of two half-reactions:

Now, we can make the same reaction take place even if the copper ions and zinc rod are not in direct contact. If we put the  $\text{Cu}^{2+}$  ions and Zn rod in two separate containers and connect the two by a conducting metallic wire and introduce an inverted U shape instrument (called as salt-bridge), then electrons will still be transferred through the connecting wires. The electrons from the Zn rod travel to  $\text{Cu}^{2+}$  ions through the connecting wires and the same reaction takes place. This flow of electrons through the wire generates electricity.

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