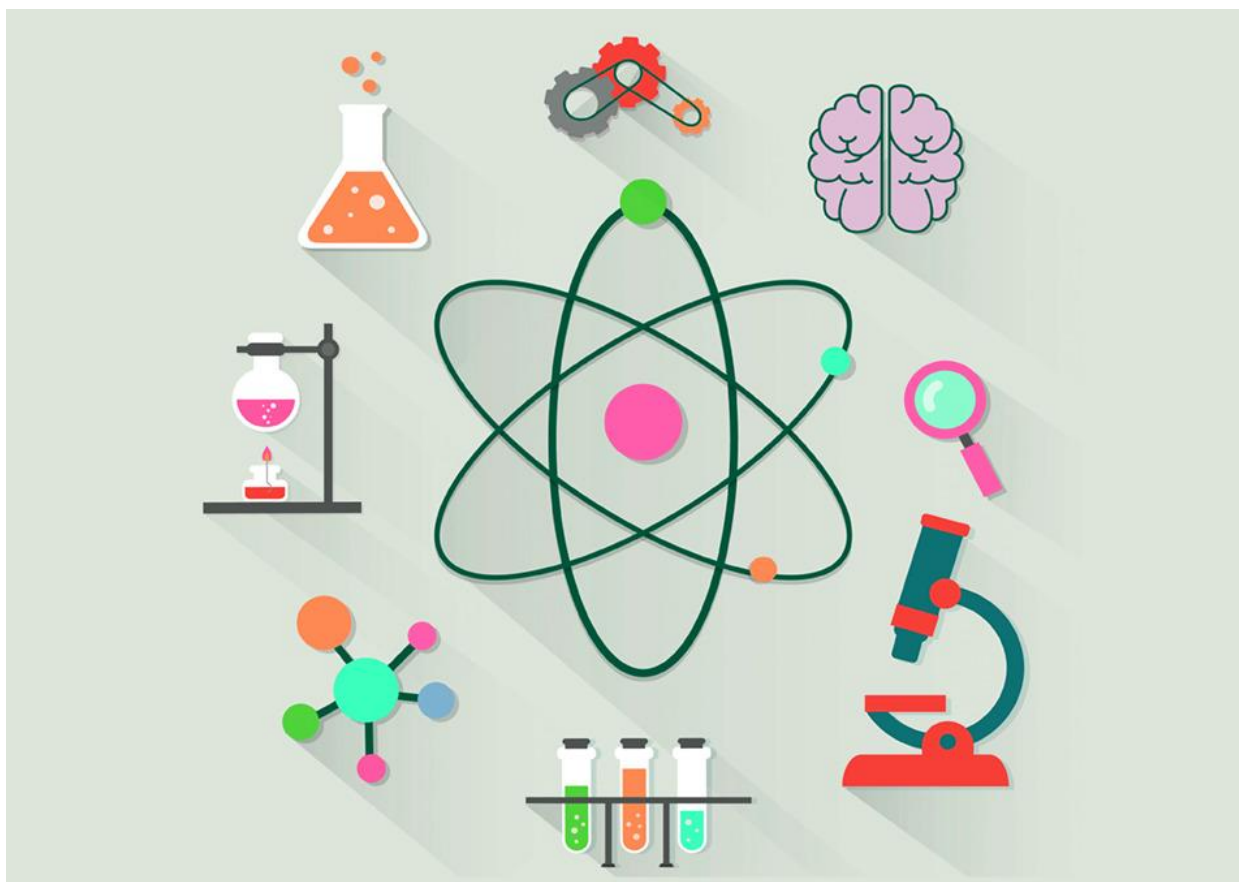


CHEMISTRY Homework

Electro-chemistry (part-I)



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Section: 4

CHE109
Engineering Chemistry-I
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Answer to the Question no 1

Spontaneous reactions are chemical reactions that take place without the influence of external forces or without being driven by an outside force.

Spontaneous changes are also known as natural.

Examples of spontaneous redox reaction are:

- Rusting of irons.
- Galvanic cell.

Non-spontaneous reactions are those chemical reactions that require energy to proceed with the reaction without external forces. In this case, the total energy of the products is higher than that of the reactants.

Example of non-spontaneous reactions are:

- Diffusion of gas from low pressure.
- Electrolytic cell

Answer to the Question no 2

The principles of galvanic and electrolytic cells are:

Galvanic cell:

- Chemical energy is converted to electrical energy
- Spontaneous redox reaction occurs
- Anode is negatively charged, and cathode is positively charged
- Electrons flow from anode to cathode through an external circuit

Salt bridge maintains electrical neutrality and allows ion flow

Electrolytic cell:

- Electrical energy is converted to chemical energy
- Non-spontaneous redox reaction occurs
- Anode is positively charged, and cathode is negatively charged
- Electrons flow from cathode to anode through an external circuit
- Electrolyte provides the ions necessary for the reaction to occur.

Answer to the Question no 3

Electroplating: Electroplating is an electrolytic cell required for electroplating.

Electrical battery: An electrical battery is a galvanic cell, which converts chemical energy into electrical energy. That is why a galvanic cell is required.

Decomposition of HCl into H₂ and Cl gas: The decomposition of HCL into H₂ and Cl gas is an electrolytic process, which requires an electrolytic cell. The HCl solution will be the electrolyte, and the anode will be made of an inert material like platinum, while the cathode will be a material that can reduce H⁺ ions to hydrogen gas, such as a metal like zinc or copper.

Fuel cell: A fuel cell is an electro-chemical cell that converts the chemical energy of a fuel, such as hydrogen or methane, directly into electrical energy. Fuel cells are typically galvanic cells, but they operate in reverse of an electrolytic cell. They use an oxidant like oxygen as the cathode and the fuel is anode. The electrolyte allows the transfer of ions between the anode and the cathode.

Answer to the Question no 4

An electrolytic cell consumes electrical energy to drive a non-spontaneous chemical reaction in the opposite direction of spontaneous reaction. For example, the electrolysis of water requires electrical energy to decompose water into hydrogen and oxygen gasses. The electrical energy is used to overcome the thermodynamic barrier to break the chemical bonds in the water molecule. Therefore, an electrolytic cell's output is a product of the chemical reaction, such as the hydrogen and oxygen gasses produced in the electrolysis of water.

Answer to the Question no 5

In an electrolytic cell, the anode is positive and the cathode is negative because the external power source is connected in such a way that it drives the flow of electron from the negative terminal (cathode) to the positive terminal (anode).

As a result, the anode becomes positively charged due to the loss of electrons, while the cathode becomes negatively charged due to the gain of electrons.

Answer to the Question no 6

Strong electrolytes: Strong electrolytes are substances that completely dissociate into ions in aqueous solutions and conduct electricity very well. Such as salts, strong acids, and strong bases.

Active electrodes: Active electrodes are electrodes that participate in the chemical reaction during electrolysis and undergo oxidation or reduction such as the anode and the cathode.

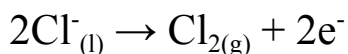
Inert electrodes: This electrode does not participate in chemical reaction during electrolysis and serves only as a surface for the transfer of electrons. Such as- platinum, gold, or graphite electrodes.

Electrolysis: Electrolysis is the process of using an electric current to drive a non-spontaneous chemical reaction such as- Decomposition of water into hydrogen and oxygen, which occurs at the anode and cathode, respectively.

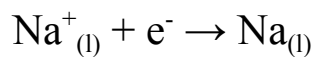
Answer to the Question no 7

The electrolysis of molten NaCl involves the application of a direct electric current to a molten mixture of sodium chloride (NaCl) and calcium chloride (CaCl₂). The process takes place in an electrolytic cell containing a graphite anode and a steel a ceramic or fused quartz diaphragm to prevent the mixing of the products.

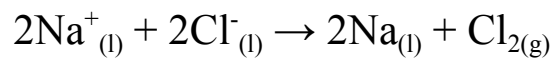
Anode:



Cathode:



Overall:



The chlorine gas is collected at the anode, while the molten sodium metal floats to the top of the electrolytic cell, where it is removed. This process is used on an industrial scale to produce large quantities of sodium metal and chlorine gas.