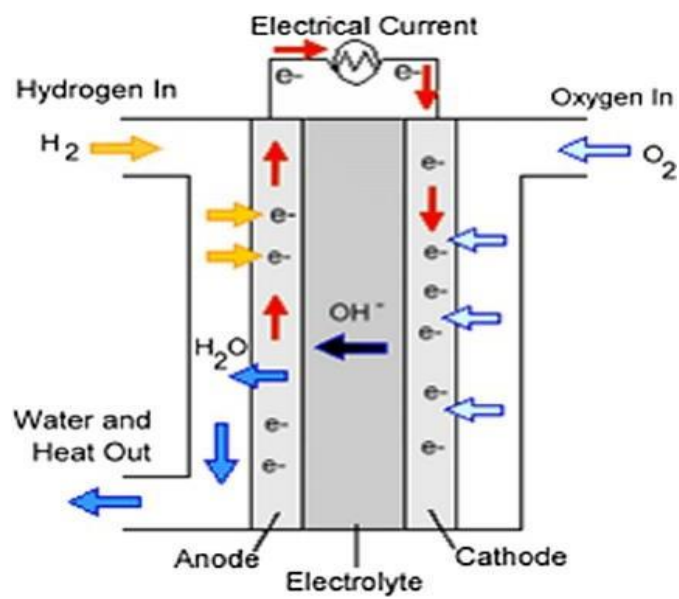


UNIT IV
FUEL CELL

Alkaline fuel cell

An alkaline fuel cell is an electrochemical device that **converts the chemical energy of hydrogen and oxygen directly into electricity** using an **alkaline electrolyte** (usually KOH solution).



Description

- ❖ Fuel – H₂
- ❖ Oxidant – O₂
- ❖ Electrolyte – KOH solution

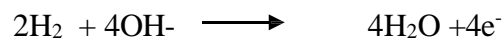
Principle:

- **Electrochemical oxidation–reduction (redox) reactions takes place.**
- Hydrogen gas is supplied to the anode, oxidation occurs.
- It produces electrons and hydroxide ions.
- Oxygen gas is supplied to the cathode, reduction occurs.
- It combines with electrons and hydroxide ions to form water.
- Concentrated KOH is used as an electrolyte
- It conducts OH⁻ ions
- External Circuit: Electrons flow from anode to cathode, producing current.

Working:

Anode Reaction (Oxidation)

- H₂ is oxidized

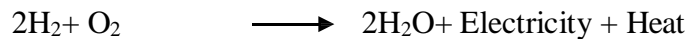


Cathode Reaction (Reduction)

- O₂ gas is bubbled through cathode compartment
- O₂ is reduced



Over all Reaction



Advantages

- High electrical efficiency (60%)
- Produces **pure water** as by-product
- Operates at **low temperatures**
- **Quick start-up time** for applications like spacecraft

Disadvantages

- Requires **pure hydrogen and oxygen**
- **Sensitive to CO₂** → requires scrubbing of air
- Electrolyte **maintenance** is needed (KOH concentration)
- Not suitable for large-scale terrestrial power plants
- High maintenance cost

Applications

Used in

- Spacecraft (NASA Apollo, Shuttle programs)
- Submarines and underwater vehicles
- Backup power systems for sensitive equipment
- Small-scale portable power generation