Electrochemistry

Oxidation-reduction: "Redox"

Electrochemistry:

study of the interchange between chemical change and electrical work

Electrochemical cells:

systems utilizing a redox reaction to produce or use electrical energy

Redox

Oxidation is loss of e^-

O.N. increases (more positive)

Reduction is gain of e^-

O.N. decreases (more negative)

Oxidation involves loss

Reduction involves gain

Redox Terminology

PROCESS	$Zn(s) + 2H^+(aq) \longrightarrow Zn^{2+}(aq) + H_2(g)$
OXIDATION • One reactant loses electrons • Reducing agent is oxidized • Oxidation number increases	Zinc **loses** electrons. Zinc is the reducing agent and becomes **oxidized.** The oxidation number of Zn **increases** from 0 to +2.
REDUCTION • Other reactant gains electrons • Oxidizing agent is reduced • Oxidation number decreases	Hydrogen ion **gains** electrons. Hydrogen ion is the oxidizing agent and becomes **reduced.** The oxidation number of H^+ **decreases** from +1 to 0.

Common Components

- Electrodes:

  conduct electricity between cell and surroundings

Working electrodes, reference electrodes, counter electrodes

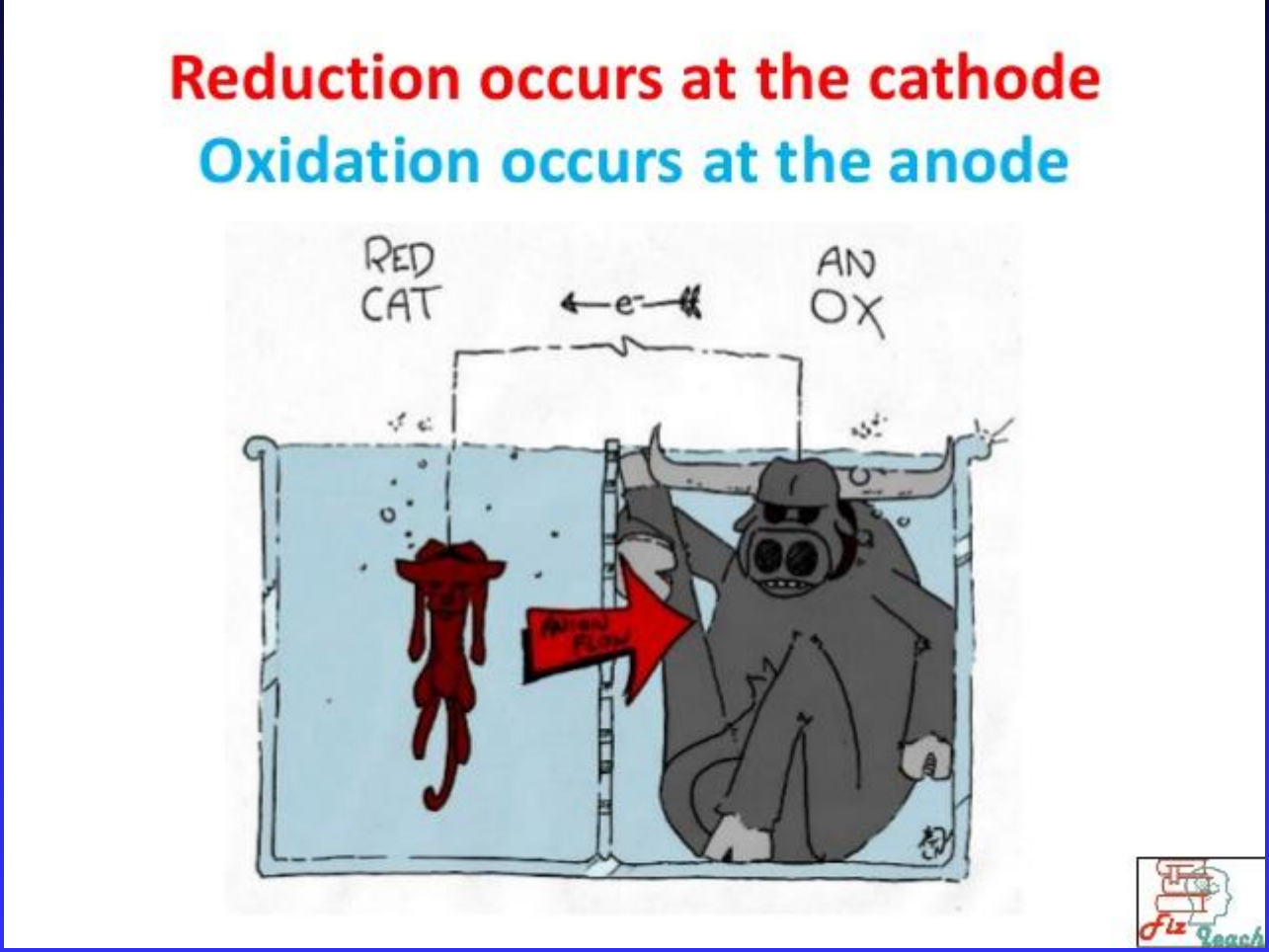
- Electrolyte:

  mixture of ions involved in reaction or carrying charge

- Salt bridge:

  completes circuit (provides charge balance)

Electrodes



Active electrodes: participate in redox

Inactive: sites of ox. and red.

Electrochemical cell characteristics

1. Thermodynamics
2. Kinetics

- *Polarization*
- *Ohmic drop*
- *Electron transfer resistance*
- *Diffusion limitations*
- *Reversibility/irreversibility*
- *Cyclability*

Techniques for testing electrodes and cells

Voltammetry

Galvanostatic charge discharge

Electrochemical impedance spectroscopy