

# Activity and Electricity

## List

- describe an electrochemical cell
- describe voltaic cells and electrolytic cells

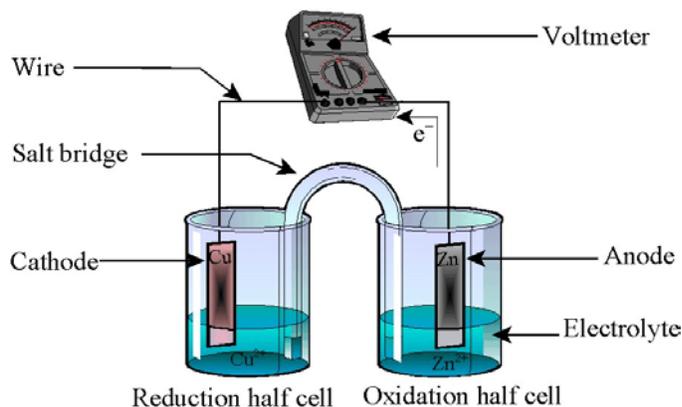
## Notes

### Electrochemical cells

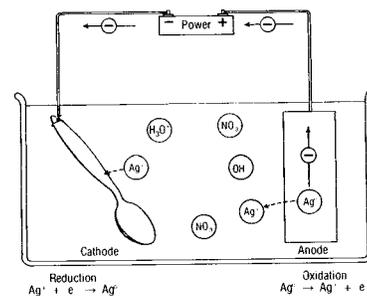
- ★ Functioning of the electrochemical cell
  - ☆ During a single replacement reaction, more active metals transfer electrons to less active metals
    - ☆ the more active metal is oxidized
    - ☆ the less active metal is reduced
  - ☆ If the oxidation and reduction half reactions are physically separated and attached by a wire, electrons will flow through the wire during the reaction
- ★ Parts of an electrochemical cell
  - ☆ electrodes
    - ☆ anode — place where oxidation occurs
    - ☆ cathode — place where reduction occurs
  - ☆ half cells — separate containers in which oxidation and reduction half reactions occur

### The Electrode Zoo

**AN OX** — ANode = OXidation  
**RED CAT** — CATHode = REDuction



- ☆ U-tube or salt bridge — lets ions travel between half cells to complete the circuit
- ★ Examples of electrochemical cells
  - ☆ Voltaic Cells (Spontaneous Reactions)
    - ☆ Definition — a system that uses a chemical reaction to produce electricity
    - ☆ Examples
      - ☆ lead acid storage battery (automobile battery)
      - ☆ dry cell (zinc container anode, carbon center post cathode)
  - ☆ Electrolytic cells (Nonspontaneous Reactions)
    - ☆ Definition — a system that uses electricity to cause a chemical reaction
    - ☆ Examples
      - ☆ recharging a car battery:  
 $2\text{PbSO}_4 + 2\text{H}_2\text{O} \rightarrow \text{PbO}_2 + \text{Pb} + 2\text{H}_2\text{SO}_4$
      - ☆ electrolysis of molten sodium chloride  
 $2\text{NaCl} \rightarrow 2\text{Na}^0 + \text{Cl}_2^0$
      - ☆ electroplating



**Answer the questions below by circling the number of the correct response**

- Which reaction will take place in a 1.0 molar aqueous solution?
  - $\text{Cu} + \text{Ag}^+ \rightarrow$
  - $\text{Ag} + \text{Mn}^{2+} \rightarrow$
  - $\text{Co} + \text{Zn}^{2+} \rightarrow$
  - $\text{Sn} + \text{Fe}^{2+} \rightarrow$
- Which reaction occurs at the positive electrode during the electrolysis of molten sodium chloride?
  - chloride ions are reduced
  - sodium ions are reduced
  - chloride ions are oxidized
  - sodium ions are oxidized
- Strips of zinc are placed in solutions of the salts listed below. In which solution will a redox reaction take place?
  - $\text{Ca}(\text{NO}_3)_2$
  - $\text{Mg}(\text{NO}_3)_2$
  - $\text{Ni}(\text{NO}_3)_2$
  - $\text{Sr}(\text{NO}_3)_2$
- When the reaction of a chemical cell reaches equilibrium, the potential difference of the cell
  - decreases
  - increases
  - remains the same
- When electroplating with silver, the mass of the positive electrode
  - decreases
  - increases
  - remains the same
- When electroplating with silver, the mass of the negative electrode
  - decreases
  - increases
  - remains the same
- Which of the following half cells is used as the standard?
  - $\text{F}_2 + 2\text{e}^- = 2\text{F}^-$
  - $\text{Li}^+ + \text{e}^- = \text{Li}(\text{s})$
  - $2\text{H}^+ + 2\text{e}^- = \text{H}_2$
  - $\text{Ag}^+ + \text{e}^- = \text{Ag}$
- Oxygen and copper are produced during the electrolysis of a  $\text{CuSO}_4$  solution. Which reaction occurs at the negative electrode?
  - the copper atom is oxidized
  - the copper ion is reduced
  - the oxygen atom is oxidized
  - the oxygen ion is reduced
- Oxidation will occur in the  $\text{Ni}, \text{Ni}^{2+}(1 \text{ M})$  half-cell when it forms a cell with
  - $\text{Al}, \text{Al}^{3+}(1 \text{ M})$
  - $\text{Au}, \text{Au}^{3+}(1 \text{ M})$
  - $\text{Sr}, \text{Sr}^{2+}(1 \text{ M})$
  - $\text{Zn}, \text{Zn}^{2+}(1 \text{ M})$
- In the electrolysis of fused  $\text{CaCl}_2$ , the species that reacts at the negative electrode is
  - $\text{Ca}$
  - $\text{Ca}^{2+}$
  - $\text{Cl}_2$
  - $\text{Cl}^-$