CONCEPT: GALVANIC CELL

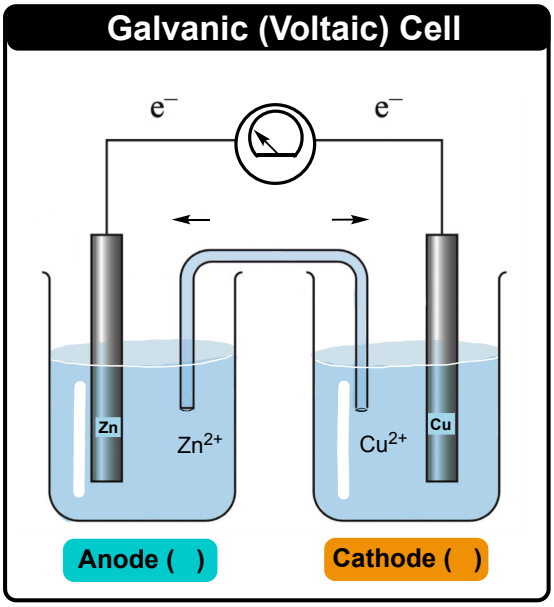
- **Galvanic Cell** (Voltaic Cell) is a _____ electrochemical cell that produces electricity, making it a battery.
  - □ Uses stored _____ energy and converts it into _____ energy.

EXAMPLE: The purpose of a galvanic cell is to:

a) Purify solids b) Allow for only oxidation c) Generate electricity d) To consume electricity

Galvanic Cell Components

- The major components of a galvanic cell are given as the following:
  - □ **Anode** (__): The metal electrode and compartment where _____ occurs. (_____ electrons)
  - □ **Cathode** (__): The metal electrode and compartment where _____ occurs. (_____ electrons)
  - □ **Salt Bridge:** A tube that connects both half cells to one another and allows for the flowing of _____ ions.
    - _____ **Ions:** Ions within solution that possess _____ acidic or basic properties.
    - Its purpose is to _____ the buildup of cations within the anion half-cell.
  - □ **Voltmeter (V)**: The device that records the amount of _____ generated by the galvanic cell.



EXAMPLE: Which of the following statements is true for a salt bridge dealing with the following redox reaction:

$$Mg\ (s) + Cd^{2+}\ (aq) \longrightarrow Mg^{2+}\ (aq) + Cd\ (s)$$

a) Its bromide ions will flow to the magnesium half-cell.

b) Its bromide ions will flow to the cadmium half-cell.

c) Contains neutral atoms that interact with the ions in both half-cell compartments.

d) Its sodium ions will flow to the magnesium half-cell.

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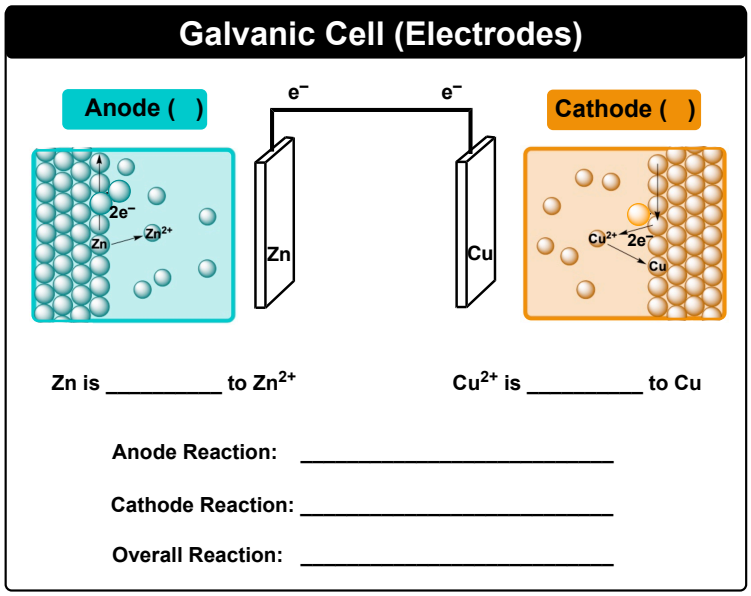
Galvanic Cell Electrodes

- Recall, all electrochemical cells possess 2 half-cell compartments one for _____ and the other for _____.
  - □ The **Anode** (__): _____ electrons and over time this causes a ____ in mass. (The anode _____ away.)
  - □ The **Cathode** (__): _____ electrons and over time this causes a ____ in mass. (The cathode _____ out.)



EXAMPLE: How many electrons would be transferred between a sodium and gallium electrode from the following?

$$Ga^{3+}(aq) + 3\,e^- \longrightarrow Ga(s)$$

$$Na(s) \longrightarrow Na^+(aq) + e^-$$

Spontaneity

- Galvanic Cell uses _____ redox reactions to produce and discharge electricity; Example; battery.
  - □ All Spontaneous redox reactions have a _____ ΔE°_{cell} value.

Spontaneity	ΔG°	ΔS°_{tot}	K_{eq}	K vs Q	E°_{cell}
Spontaneous	ΔG° __ 0	ΔS°_{tot} __ 0	K __ 1	K __ Q	E°_{cell} __ 0
At Equilibrium (Dead Battery)	ΔG° __ 0	ΔS°_{tot} __ 0	K __ 1	K __ Q	E°_{cell} __ 0

EXAMPLE: A reduction reaction with an equilibrium constant of 4.8×10^2

a) Is nonspontaneous and has a positive E°_{cell}

b) Has a negative ΔG° and produces electricity

c) Has discharged all electricity and is a dead battery

d) Is spontaneous and has a negative E°_{cell}

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PRACTICE: Which of the following is **false** about a Voltaic cell?

a) Anode electrode dissolves while cathode electrode plates out.

b) It changes chemical energy into electrical energy.

c) Anode half-cell accumulates positive charge and cathode half-cell accumulates negative charge.

d) Half reaction with more negative reduction potential attracts electrons and undergoes reduction.

PRACTICE: For the following redox reaction label: the anode, cathode, half-reactions occurring at each half-cell, direction of electron flow, and direction of neutral ions flow.

$$Ni\ (s) + Zn^{2+}\ (aq) \longrightarrow Ni^{2+}\ (aq) + Zn\ (s)$$