

Electrochemical Cells

Unit: Oxidation & Reduction

MA Curriculum Frameworks (2016): HS-PS1-10(MA)

Mastery Objective(s): (Students will be able to...)

- Explain how an electrochemical cell (such as a battery) works.

Success Criteria:

- Explanations account for each of the parts of the electrochemical cell.

Tier 2 Vocabulary: battery, bridge

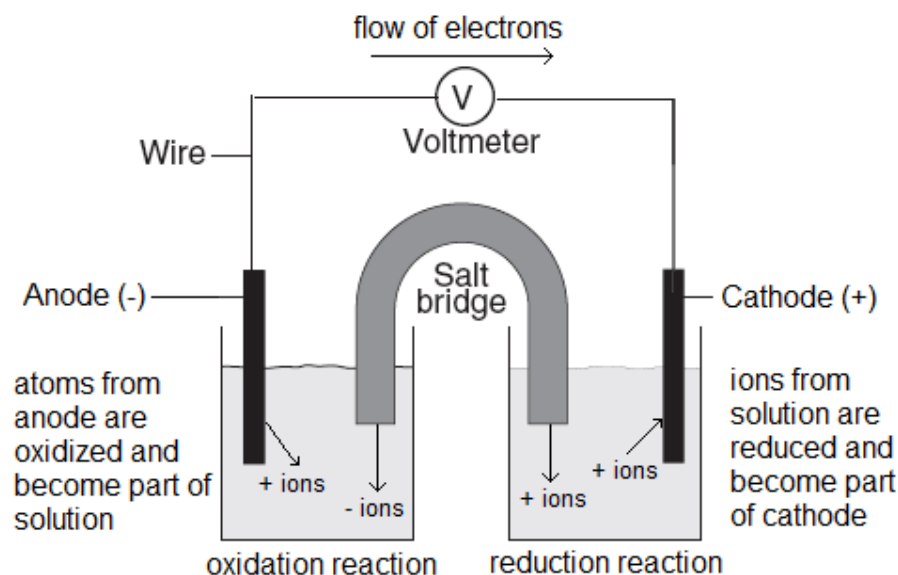
Language Objectives:

- Explain how a battery works.

Notes:

electrochemistry: using chemical (redox) reactions to produce electricity or *vice-versa*. In an electrochemical reaction, oxidation and reduction reactions occur in separate containers, and the electrons that travel from one reaction to the other pass through an electric circuit.

galvanic cell: (also called a voltaic cell) a chemical apparatus that uses an electrochemical reaction to produce electricity. (A battery is a type of galvanic cell.)



half cell: either of the two halves of a galvanic cell.

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electrolytic cell: a cell similar to a galvanic cell, except that the reaction is not spontaneous, and electricity is used to add the energy needed to make the reaction occur. (Electrolysis of water is an example.)

electrode: a solid metal strip where either oxidation or reduction occurs. The metal strips also conduct the electrons into or out of the electric circuit.

anode: the negatively (-) charged electrode. At the anode:

- Oxidation happens. (Atoms from the anode are oxidized to positive ions.)
- These metal ions become part of the solution. (*i.e.*, the anode loses mass.)
- The electrons produced by oxidation move up the wire into the electric circuit.

cathode: the positively (+) charged electrode. At the cathode:

- Reduction happens. (Ions from the solution are reduced to neutral metal atoms.)
- These metal ions become part of the cathode. (*i.e.*, the cathode gains mass.)
- The electrons needed for reduction move from the electric circuit through the wire and into the cathode.

Note that in physics, electric "current" is defined to be the direction that a positive particle would move. This means that the "current" flows in the opposite direction from the electrons.

salt bridge: a salt solution that is connected to both half cells. The salt bridge provides ions for the two half-cells to keep the charges balanced. (If the charges are not allowed to balance, opposite charges would build up in both cells and the reaction would stop.) The salt solution must be made of ions that do not take part in the reactions at the cathode or anode. (KNO_3 is commonly used.)

electroplating: using an electrolytic cell to add a layer of metal to something. The cathode is attached to the object to be electroplated. An electric current reduces metal ions from the solution, which are deposited onto the object.

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