

Kenai Peninsula Borough School District
Science: Chemistry
Unit 10: REDOX REACTIONS AND ELECTROCHEMISTRY

Pacing:

NGSS Standards:

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

ELA/LITERACY:

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),(HS-PS1-6)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)(HS-PS3-1)(HS-PS3-3)

MATHEMATICS:

MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7) (HS-PS3-1)(HS-PS3-3)

- a. decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- b. reflect during the manipulation process in order to probe into the meanings for the symbols involved
- c. create a coherent representation of the problem
- d. make sense of quantities and their relationships in problem situations
- e. attend to the meanings of quantities
- f. use flexibility with different properties of operations and objects
- g. translate an algebraic problem to a real world context
- h. explain the relationship between the symbolic abstraction and the context of the problem
- i. compute using different properties
- j. consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (HS-PS1-4) (HS-PS3-1)(HS-PS3-3)

- a. apply mathematics to solve problems in everyday life, society, and workplace
- b. identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- c. consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- d. apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- e. make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- f. identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- g. analyze quantitative relationships to draw conclusions
- h. improve the model if it has not served its purpose

HSN-Q. 1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7), (HS-PS3-1)(HS-PS3-3)

HSN-Q. 2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7) (HS-PS3-1)(HS-PS3-3)

HSN-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7) (HS-PS3-1)(HS-PS3-3)

ESSENTIAL QUESTIONS:

Describe the process of oxidation and reduction.

Explain the role of oxidizing agents and reducing agents in a redox reaction. How is each changed in the reaction?

Determine the oxidation numbers in the following compounds

Balance the following equations using the oxidation number method

Balance the following equations using the half reaction method

Under what conditions can a redox reaction be used to cause an electric current to flow through a wire?

What are the components of a voltaic cell? What is the role of each component?

Explain how primary and secondary batteries differ and give an example of each type.

Define electrolysis and relate the definition to the spontaneity of redox reactions.

BIG IDEAS:

An oxidation reductions (redox) reaction is an chemical reaction in which electrons are transferred from one atom to another.

The oxidation- number method can used to balance more difficult redox reactions.

The oxidation reduction processes of a redox reaction can be represented by half reactions.

Definition of voltaic cell

Types of batteries and their uses

Electrolysis and electroplating.

Vocabulary: Half reaction, Oxidation, Oxidation-number method, Oxidation reduction reaction

Oxidizing agent, Redox reaction, Reducing agent, Reduction, Species, Anode, Battery, Cathode

Corrosion, Dry cell, Electrochemical cell, Electrolysis, Electrolytic cell, Fuel cell, Reduction potential, Salt bridge, Standard hydrogen electrode, Voltaic cell