

ARISE Curriculum Guide

Chemistry: Topic 22—Redox/Electrochemistry

ChemMatters

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Articles for Student Use

Apollo 13's Fight for Survival: Feb. 1994, pp. 5-8.
Automatic Sunglasses: Dec. 1989, pp. 4-6.
Colors Bursting in Air: Oct. 1998, pp. 7-9.
Fire in the Hold: April 1997, pp. 11-13.
Friedrich Wohler's Lost Aluminum: Oct. 1990, pp. 14-15.
Insect Arsenals: Oct. 1993, pp. 8-10.
Iron for Breakfast: Oct. 1994, pp. 13-15.
The New Gold Rush: Oct. 1989, pp. 4-4-8.
Mighty Thermite: Feb. 2002, pp. 14-15.
Rockets: Chemistry Model for Liftoff: April 2001.
Permanent Waves: April 1993, pp. 8-11.
Silver Lightning: Dec. 1996, pp. 4-5.
The Smell of Danger: Oct. 1988, pp.9-13.
Treasure: April 1987, pp. 4-9.

Articles for Teacher Use

Number and Topic:	4. Atomic Structure 8. Chemical Reactions 11. Thermochemistry 22. Redox/Electrochemistry
Source:	<i>ChemMatters</i> , Oct. 1998, pp. 7-9, "Colors Bursting in Air"
Type of Material:	Student Journal Article
Building on:	Atomic structure, electron transitions in atoms
Leading to:	Redox
Links to Physics:	Electromagnetic spectrum, light, electrons
Links to Biology:	
Good Stories:	
Activity Description:	Article discusses the chemistry and electron transitions that produce the colors seen in fireworks.

Number and Topic: 8. Chemical Reactions
15. Ionic and Metallic Bonds
16. Covalent Bonds, Molecular Shapes and Intermolecular Forces
20. Acids/Bases/pH
21. Organic Chemistry
22. Redox/Electrochemistry

Source: *ChemMatters*, April 1993, pp. 8-11, "Permanent Waves"
Type of Material: Student Journal Article
Building on: Molecular structures, acids and bases
Leading to: Hydrogen bonds, amino acids, proteins,
Links to Physics:
Links to Biology: Structure of human hair, proteins
Good Stories:
Activity Description: Article details the complex structure of human hair and how permanent waves act on hair to produce their effect.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions
13. Electrons in Atoms
17. Water, Aqueous Solutions
18. Reaction Rates and Kinetics
22. Redox/Electrochemistry

Source: *ChemMatters*, Oct. 1994, pp. 13-15, "Iron for Breakfast"
Type of Material: Student Journal Article and Activity
Building on: Chemical names and formulas, electrons in atoms
Leading to: Catalysis, redox reactions
Links to Physics: Magnetism
Links to Biology: Hemoglobin, the function of iron in human biology
Good Stories:
Activity Description: Article relates the nature of iron in human metabolism and the biological effects of having too much or too little.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions
20. Acid/Bases/pH
22. Redox/Electrochemistry

Source: *ChemMatters*, Oct. 1989, pp. 4-4-8, "The New Gold Rush"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Acids, bases, redox
Links to Physics:
Links to Biology: How bacteria can actually be used in some gold recovery processes
Good Stories:
Activity Description: Article discusses the history of gold mining, from crude early methods to modern sophisticated processes, going into detail about the chemical reactions and various processes that are employed.

Number and Topic: 8. Chemical Reactions
11. Thermochemistry
15. Ionic and Metallic Bonds
22. Redox/Electrochemistry

Source: *ChemMatters*, Feb. 2002, pp. 14-15, "Mighty Thermite"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Thermochemistry and redox

Links to Physics: Matter, energy, thermodynamics, heat, entropy

Links to Biology:

Good Stories:

Activity Description: Article describes the thermite reaction, its history, the thermodynamics behind it, and some of its practical applications.

Number and Topic: 8. Chemical Reactions
9. Stoichiometry
11. Thermochemistry
12. Gases/Gas Laws/Kinetic Theory
22. Redox/Electrochemistry/Electrochemistry

Source: *ChemMatters*, April 2001, "Rockets: Chemistry Model for Liftoff"

Type of Material: Student Journal Article

Building on: Properties of compounds and elements, chemical reactions, gas laws

Leading to: Redox reactions

Links to Physics: Strong links to motions and forces and kinematics as well as measurement

Links to Biology:

Good Stories:

Activity Description: Article describes the basic principles behind the operation of a model rocket, both chemical and physical.

Number and Topic: 8. Chemical Reactions
22. Redox/Electrochemistry

Source: *ChemMatters*, Dec. 1996, pp. 4-5, "Silver Lightning"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Redox and electrochemistry

Links to Physics:

Links to Biology:

Good Stories: Entire article is a "good story."

Activity Description: The article discusses and evaluates the product claims of a product called "Silver Lightning." The product claims to be able to remove tarnish from silver products with no scrubbing. Interestingly enough, the product does work, although a plain piece of aluminum foil will evidently produce the same results at a fraction of the cost.

Number and Topic: 8. Chemical Reactions
22. Redox/Electrochemistry
Source: *ChemMatters*, Feb. 1994, pp. 5-8, "Apollo 13's Fight for Survival"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Acids and bases, redox, fuel cells
Links to Physics: Motion and forces
Links to Biology: Respiration
Good Stories: Article deals with the Apollo 13 disaster and how the crew and the scientists at mission control were able to bring the astronauts safely back to earth.
Activity Description: The article does a nice job of blending the dramatic nature of the Apollo crises with the chemistry involved in maintaining the life-support system for the astronauts and providing the energy needed to get them back to earth safely.

Number and Topic: 8. Chemical Reactions
21. Organic Chemistry
22. Redox/Electrochemistry
Source: *ChemMatters*, Oct. 1993, pp. 8-10, "Insect Arsenals"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Organic chemistry, redox
Links to Physics:
Links to Biology: Numerous links to evolution, adaptations, behaviors, heredity
Good Stories: Several interesting stories of unusual methods by which some insects defend themselves against predators.
Activity Description: Article discusses the general topic of how insects utilize chemical defenses and includes several very specific examples, explaining in detail the chemical reactions involved.

Number and Topic: 8. Chemical Reactions
22. Redox/Electrochemistry
Source: *ChemMatters*, Oct. 1990, pp. 14-15, "Friedrich Wohler's Lost Aluminum"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Oxidation-reduction and electrochemistry
Links to Physics:
Links to Biology:
Good Stories: At one time aluminum was a more precious than gold or silver. The metal was actually displayed along with the French crown jewels.
Activity Description: The article discusses the history of aluminum and the various processes by which it was isolated from its ores.

Number and Topic: 8. Chemical Reactions
13. Electrons in Atoms
19. Equilibrium
22. Redox/Electrochemistry

Source: *ChemMatters*, Dec. 1989, pp. 4-6, "Automatic Sunglasses"

Type of Material: Student Journal Article

Building on: Chemical reactions, electrons in atoms

Leading to: Equilibrium, redox

Links to Physics: Light, electromagnetic spectrum

Links to Biology:

Good Stories:

Activity Description: Article describes the reactions and mechanisms involved in photochromic sunglasses that darken when exposed to sunlight but turn clear when you come back indoors.

Number and Topic: 8. Chemical Reactions
19. Equilibrium
20. Acid/Bases/pH
22. Redox/Electrochemistry

Source: *ChemMatters*, April 1987, pp. 4-9, "Treasure"

Type of Material: Student Journal Article

Building on: Basic chemical knowledge

Leading to: Discussion of acid-base and redox reactions, including equilibrium considerations and then continuing to a discussion of electrolysis, and how all of these chemical concepts can be applied to restoring articles that are recovered from a sunken ship.

Links to Physics: Electricity

Links to Biology:

Good Stories: Stories of the sinking of the ship Atocha and its recovery

Activity Description: Article deals with all the chemistry involved in restoring objects lifted from sunken ships that have been lying at the bottom of the sea for hundreds of years.

Number and Topic: 21. Organic Chemistry
22. Redox/Electrochemistry

Source: *ChemMatters*, Oct. 1988, pp.9-13, "The Smell of Danger"

Type of Material: Student Journal Article

Building on: Chemical reactions, molecular structures

Leading to: Organic chemistry

Links to Physics:

Links to Biology: Anosmia—the inability to detect odors

Good Stories: How propane stored in tanks can lose its ethyl mercaptan odor and thus not protect people in the event of a leak.

Activity Description: The article deals with the addition of mercaptans to propane so as to provide the gas with an odor that can be detected in the event of a gas leak and how and why these mercaptans can be destroyed by reactions that may occur within the storage tank.

Number and Topic:	8. Chemical Reactions 11. Thermochemistry 22. Redox/Electrochemistry
Source:	<i>ChemMatters</i> , April 1997, pp. 11-13, "Fire in the Hold"
Type of Material:	Student Journal Article
Building on:	Chemical reactions
Leading to:	Oxidation-reduction, Reaction Rates
Links to Physics:	
Links to Biology:	
Good Stories:	Tells of the explosion of a Turkish ship in 1996 that was caused by unintended oxidation of porous iron pellets stored.
Activity Description:	Article explains the scientific principles that resulted in the spontaneous oxidation of the iron pellets—for example, the large surface area that was exposed because of the porous nature of the particles.

Flinn ChemTopic Labs
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Demo: Acid in the Eye – Safety
 Demo: A Burning Candle - Observations
 Demo: Classifying Matter
 Demo: Flaming Vapor Ramp—Safety Demo
 Lab: Observation and Experiment - Introduction to the Scientific Method
 Lab: Separation of a Mixture - Percent Composition
 Lab: What is a Chemical Reaction - Evidence of Change
 Lab: Common Gases—Physical and Chemical Properties
 Lab: Preparing and Testing Hydrogen Gas—A Microscale Approach
 Lab: Carbon Dioxide - What a Gas—Microscale Gas Chemistry

ICE LABS

[Online Descriptions and Experiments](#)

Number and Topic:	22. Redox/Electrochemistry
Source:	ICE Laboratory Leadership
Type of Material:	Lab 15. How to Copper Plate Your Car Keys
Building on:	2. Measurement. 13. Electrons in atoms.
Leading to:	15. Ionic and metallic bonds
Links to Physics:	Electroplating/cathodic protection
Links to Biology:	Many biological reactions include redox processes.
Good Stories:	
Activity Description:	To investigate the mass changes, if any, at each electrode during electroplating and to calculate the charge on the copper ion through application of Faraday's Laws. Electroplating can be used to deposit a layer of metal such as chromium, copper, gold, nickel, or zinc on another metal. This deposit can provide a protective and decorative coating for the metal that lies beneath it. This laboratory activity will show you how to electroplate a copper coating on a car key or other suitable metallic object.

Technology-Adapted Labs

No activities for this topic.