

ARISE Curriculum Guide

Chemistry: Topic 8—Chemical Reactions

ChemMatters

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Articles for Student Use

Airbags: Chemical Reaction Saves Lives: Feb. 1997, pp. 4-5.
Apollo 13's Fight for Survival: Feb. 1994, pp. 5-8.
Automatic Sunglasses: Dec. 1989, pp. 4-6.
Biosphere II: Feb. 1995, pp. 8-11.
A Calorie-free Fat? April 1999, pp. 9-11.
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Carbon Dioxide: A Pourable Greenhouse Gas: Sep. 2001, pp. 10-11.
Caves: Chemistry Goes Underground: April 2002, pp. 7-9.
Chemiluminescence, the Cold Light: Oct. 1995, pp. 12-15.
Colors Bursting in Air: Oct. 1998, pp. 7-9.
Designer Catalysts: April 1994, pp. 13-15.
Dissolving Plastic: Oct. 1987, pp. 12-15.
Distance Running: Feb. 1989, pp. 4-7.
The Exploding Tire: April 1988, pp. 12-14.
The Explosive History of Nitrogen Feb. 2003, pp. 8-10.
Fats: Fitting them into a Healthy Diet: Oct. 2000, pp. 6-8.
Fire in the Hold: April 1997, pp. 11-13.
Fireside Dreams: Dec. 1988, pp. 13-15.
Friedrich Wohler's Lost Aluminum: Oct. 1990, pp. 14-15.
Going Against the Flow: The Isolation of Fluorine: Dec. 1986, pp. 13-15.
Hot and Cold Packs: Feb. 1987, pp. 7-11.
Hydrogen Fuel Cells for Future Cars: Dec. 2000, pp. 4-6.
Insect Arsenals: Oct. 1993, pp. 8-10.
The Interrupted Party: Oct. 1984, pp. 4-5.
Iron for Breakfast: Oct. 1994, pp. 13-15.
Is Water the Best Fire Extinguisher in the Kitchen? April 2001, p. 2.
Leavening: How Great Cooks Loaf: April 1996, pp. 4-5.
Luminol. Casting a Revealing Light on Crime: Dec. 2001, pp. 12-13.
Matches. Striking Chemistry at Your Fingertips: Dec. 2002, pp. 14-16.
Mighty Thermite: Feb. 2002, pp. 14-15.
Ozone—Out of Bounds: 1998, pp. 12-14.
Polymers: April 1986, pp. 4-7.
Rockets: Chemistry Model for Liftoff: April 2001.
The New Gold Rush: Oct. 1989, pp. 4-4-8.
Nitrous Oxide: By no Means a Laughing Matter: Feb. 1986, pp. 17-19.
Nylon: Dec. 1990, pp. 4-6.
Ozone: Molecule with a Split Personality: Sep. 2001, pp. 7-9.

Permanent Waves: April 1993, pp. 8-11.
 Real Leather: April 1990, pp. 4-6.
 Saint's Blood: Feb. 1993, pp. 12-15.
 Silver Lightning: Dec. 1996, pp. 4-5.
 Skunk Non-scents: Oct. 1996, pp. 7-9.
 Soap: Feb. 1985, pp. 4-7, p. 12.
 Treasure: April 1987, pp. 4-9.
 Volcanoes-Forecasting the Fury: Dec. 1999, pp. 12-13.
 Wastewater: April 1992, pp. 12-15.
 When Good Ideas Gel: Dec. 1992, pp. 14-15.

Articles for Teacher Use

Number and Topic: 1. Matter and Change
 6. Chemical Names and Formulas/Compounds and Elements
 8. Chemical Reactions
 10. Phases, Solids, Liquids and Gases (States of Matter)
 11. Thermochemistry,

Source: *ChemMatters*, Dec. 2002, pp. 14-16, "Matches. Striking Chemistry at Your Fingertips"

Type of Material: Student Journal Article

Building on: Chemical names and formulas/compounds and elements, chemical reactions and thermochemistry

Leading to: Reaction rates, redox reactions

Links to Physics: Matter, energy, thermodynamics, heat

Links to Biology:

Good Stories: Entire article is a "good story"

Activity Description: Article describes the history of the development of the common match, covering early matches and their inherent weaknesses and dangers. Good review of chemical equations and/or a review or introduction to redox reactions.

Number and Topic: 2. Measurement
 8. Chemical Reactions
 20. Acids/Bases/pH

Source: *ChemMatters*, Feb. 1995, pp. 8-11, "Biosphere II"

Type of Material: Student Journal Article

Building on: Measurement, chemical reactions

Leading to: Acids/bases/pH

Links to Physics:

Links to Biology: Ecosystems, respiration, bacterial action

Good Stories: Entire article is a story

Activity Description: Article relates the attempt to build a completely enclosed ecosystem in which humans could live for years and the problems that arose, especially those of falling oxygen and rising carbon dioxide levels. A lot of fundamental acid-base chemistry is presented in the article.

Number and Topic: 3. Problem Solving
Source: *ChemMatters*, April 2003, pp. 8-9, Student activity relating to the rate of energy release by a Bunsen burner, an electric hotplate and a microwave oven
Type of Material: Activity
Building on: Basic ability to do energy calculations
Leading to: Measuring and comparing the rate at which water can be heated by a Bunsen burner, and electric hotplate, and a microwave oven.
Links to Physics: Energy
Links to Biology:
Good Stories: None
Activity Description: This is a student activity measuring and comparing the rate at which water can be heated by a Bunsen burner, and electric hotplate, and a microwave oven.

Number and Topic: 4. Atomic Structure
8. Chemical Reactions
21. Organic Chemistry
Source: *ChemMatters*, Dec. 2001, pp. 12-13, "Luminol. Casting a Revealing Light on Crime"
Type of Material: Student Journal Article
Building on: Atomic structure, chemical reactions
Leading to: Organic chemistry
Links to Physics: Electromagnetic spectrum
Links to Biology: Living matter, composition of blood
Good Stories: Luminol can be used to detect the possible presence of blood at a crime scene.
Activity Description: Article describes how luminol reacts with blood (and other substances) and how the reaction produces a product whose electrons are in a high energy state but then fall to a lower state with the emission of visible light.

Number and Topic: 4. Atomic Structure
8. Chemical Reactions
11. Thermochemistry
22. Redox/Electrochemistry
Source: *ChemMatters*, 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: 4. Atomic structure
8. Chemical Reactions
13. Electrons in Atoms

Source: *ChemMatters*, Oct. 1995, pp. 12-15, "Chemiluminescence, the Cold Light"

Type of Material: Student Journal Article

Building on: Electromagnetic spectrum, chemical reactions, electrons in atoms

Leading to: Organic chemistry

Links to Physics: Atoms, electromagnetic spectrum, light

Links to Biology: Bacteria, bioluminescence

Good Stories: Several interesting stories of how specific organisms utilize bioluminescence in their daily quests for survival.

Activity Description: Article deals with the entire subject of chemiluminescence. It details the kinds of chemical reactions typically involved, presenting specific examples and several practical applications of the phenomenon both in nature and in medicine.

Number and Topic: 5. Radioactivity, Fusion, Fission
8. Chemical Reactions
12. Gases/Gas Laws/Kinetic Theory

Source: *ChemMatters*, Dec. 1999, pp. 12-13, "Volcanoes—Forecasting the Fury"

Type of Material: Student Journal Article

Building on: Gases, Radioactivity, chemical reactions

Leading to: Viscosity, pH, acid rain

Links to Physics: Heat, nuclear, radioisotopes

Links to Biology:

Good Stories: Relates the story of Mt. St. Helens explosion of 1980.

Activity Description: Discusses volcanic eruptions, how and why they occur and their links to topics such as acid rain.

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
11. Thermochemistry
16. Covalent Bonds, Molecular Shapes and Intermolecular Forces
18. Reaction Rates and Kinetics

Source: *ChemMatters*, Feb. 2003, pp. 8-10, "The Explosive History of Nitrogen"

Type of Material: Student Journal Article

Building on: Basic chemical knowledge

Leading to: Discussion of bonding in nitrogen compounds and elemental nitrogen, thermochemistry and reaction rates.

Links to Physics: Matter, energy, entropy

Links to Biology:

Good Stories: What caused a terrible explosion aboard a cargo ship loaded with ammonium nitrate on April 16, 1947, killing 576 people?

Activity Description: Article deals with explosive nitrogen-containing compounds and the chemical reasons that underlie their explosive nature.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions
12. Gases/Gas Laws/Kinetic Theory
18. Reaction Rates and Kinetics and Kinetics and Kinetics

Source: *ChemMatters*, Sep. 2001, pp. 7-9, "Ozone: Molecule with a Split Personality"

Type of Material: Student Journal Article

Building on: Elements and compounds, chemical reactions, gases

Leading to: Reaction rates, chemical kinetics

Links to Physics: Atoms

Links to Biology: Animals, plants, photosynthesis, ecosystems

Good Stories: Lots of excellent "real-life" connections such as sunburn and pollution

Activity Description: The article describes how ozone is both formed and destroyed in the stratosphere and how it is formed in our immediate breathable atmosphere by the action of sunlight on various pollutants. It explains why ozone in the stratosphere is good, while ozone at street level is harmful. It discusses what is actually happening to earth's protective layer of ozone and why.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions
12. Gases/Gas Laws/Kinetic Theory

Source: *ChemMatters*, Sep. 2001, pp. 10-11, "Carbon Dioxide: A Pourable Greenhouse Gas"

Type of Material: Lab

Building on: Measurement, properties of compounds

Leading to: Chemical reactions

Links to Physics: Measurement

Links to Biology:

Good Stories:

Activity Description: Students generate carbon dioxide through a simple chemical reaction. They study its properties, both physical and chemical.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements

Source: *ChemMatters*, Feb. 2001, pp. 12-13, "Dinosaurs and Iridium. Traces of an Impact"

Type of Material: Student Journal Article

Building on: Elements

Leading to: Examination of how a controversial scientific theory is tested and eventually accepted

Links to Physics:

Links to Biology: Ecosystems, adaptations, evolution

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

Activity Description: Article describes how Walter Alvarez hypothesized that the mass extinction that occurred about 65 million years ago was caused by a meteor impact. At first ridiculed, his theory eventually became widely accepted, and the article goes through the experimental data and scientific arguments that carried the day.

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
21. Organic Chemistry

Source: *ChemMatters*, April 1990, pp. 4-6, "Real Leather"

Type of Material: Student Journal Article

Building on: Names and formulas, chemical reactions, acids, bases, pH

Leading to: Organic chemistry

Links to Physics:

Links to Biology: Structure of collagen, amino acids

Good Stories: Relates the history of leather tanning from ancient times to the present.

Activity Description: Article describes various techniques that can be used to tan leather, going into the chemical reactions involved in different processes.

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: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions

Source: *ChemMatters*, Feb. 1986, pp. 17-19, "Nitrous Oxide: By no Means a Laughing Matter"

Type of Material: Student Journal Article

Building on: Chemical formulas

Leading to: Properties of different oxides of nitrogen and practical uses of these compounds

Links to Physics:

Links to Biology: Biological effects of the ingestion of nitrous oxide

Good Stories: Early attempts to develop anesthetics

Activity Description: This article discusses various oxides of nitrogen, their formulas and uses, with an emphasis on nitrous oxide.

Number and Topic: 8. Chemical Reactions
17. Water, Aqueous Solutions
19. Equilibrium
20. Acid/ Bases/pH

Source: *ChemMatters*, April 2002, pp. 7-9, "Caves: Chemistry Goes Underground"

Type of Material: Student Journal Article

Building on: Chemical Reactions, Water, Aqueous solutions

Leading to: Equilibrium, acids, bases, pH

Links to Physics: Thermodynamics, entropy

Links to Biology: Ecosystems, energy flow

Good Stories: Good stories and photographs about sinkholes swallowing up entire homes

Activity Description: Article deals with how caves are formed. It contains some good examples of the kinds of equilibrium reactions involved and the extent to which these reactions are related to pH.

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
17. Water, Aqueous Solutions

Source: *ChemMatters*, April 2001, p. 2, "Is Water the Best Fire Extinguisher in the Kitchen?"

Type of Material: Student Journal Article

Building on: Basic knowledge of combustion

Leading to: Structures of polar and nonpolar materials and how they interact

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: Article discusses why water should not be used to put out a grease fire and some possible alternate techniques that can be used if a grease fire breaks out in your kitchen.

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: 6. Chemical Names and Formulas/Compounds and Elements
8. Chemical Reactions

Source: *ChemMatters*, Dec. 2000, pp. 4-6, "Hydrogen Fuel Cells for Future Cars"
Type of Material: Student Journal Article
Building on: Elements, Chemical Reactions
Leading to: Redox, Electrochemistry
Links to Physics:
Links to Biology: Ecosystems
Good Stories:
Activity Description: Article discusses the need for an alternative to the internal combustion engine and current research to develop cars that can utilize hydrogen fuel cells.

Number and Topic: 8. Chemical Reactions
21. Organic Chemistry

Source: *ChemMatters*, Oct. 2000, pp. 6-8, "Fats: Fitting them into a Healthy Diet"
Type of Material: Student Journal Article
Building on: Molecular structures and names and chemical reactions
Leading to: Organic chemistry, isomerism
Links to Physics:
Links to Biology: Food, lipids
Good Stories: Gives some details about the amount of fat in some common fast-food meals.
Activity Description: The article presents basic information about fats, what they are and how they are formed from glycerol and fatty acids. It goes on to discuss different kinds of fats, such as saturated and unsaturated as well as cis-trans isomers. Various types of fat substitutes are also discussed.

Number and Topic: 8. Chemical Reactions
21. Organic Chemistry
Source: *ChemMatters*, April 1999, pp. 9-11, "A Calorie-Free Fat?"
Type of Material: Student Journal Article
Building on: Organic chemistry
Leading to: Triglycerides, enzymes, carbohydrates, proteins
Links to Physics: Energy
Links to Biology: Food, lipids
Good Stories:
Activity Description: Article describes fats, their structures and formation and then moves on to fat substitutes. It describes how their structures differ from normal lipids and explains why they are "calorie free" when ingested into the human body, even though they would produce calories of heat if burned in a calorimeter.

Number and Topic: 8. Chemical Reactions
18. Reaction Rates and Kinetics
Source: *ChemMatters*, Feb. 1998, pp. 12-14, "Ozone—Out of Bounds"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Reaction rates
Links to Physics: Electromagnetic spectrum
Links to Biology:
Good Stories:
Activity Description: Article describes how ozone is produced in our atmosphere from VOCs (volatile organic compounds) and nitrogen oxides, explaining how complex the process can be.

Number and Topic: 8. Chemical Reactions
Source: *ChemMatters*, Oct. 1997, pp. 10-12, "CO Control: On the Street, In the House, Where You Live"
Type of Material: Student Journal Article
Building on: Chemical Reactions
Leading to: Function of hemoglobin in the human body
Links to Physics:
Links to Biology: Hemoglobin and its function
Good Stories: Relates some stories of actual cases of CO poisoning of groups of people and even one celebrity.
Activity Description: Discusses how CO is produced by incomplete combustion, the mechanism by which it acts as a poison, and how home CO detectors operate.

Number and Topic: 8. Chemical Reactions
12. Gases/Gas Laws/Kinetic Theory

Source: *ChemMatters*, Feb. 1997, pp. 4-5, "Airbags: Chemical Reaction Saves Lives"

Type of Material: Student Journal Article

Building on: Chemical reactions, gases

Leading to: Reaction rates

Links to Physics: Motions and forces

Links to Biology:

Good Stories: Given the ubiquitous presence of airbags in modern automobiles, it is surprising to realize that the first crash between two automobiles equipped with airbags occurred in 1990.

Activity Description: Article presents the history of the development of airbags and does a thorough job of explaining the chemical reactions and physical processes involved in their operation.

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
21. Organic Chemistry

Source: *ChemMatters*, Oct. 1996, pp. 7-9, "Skunk Non-scents"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Organic chemistry, cis-trans isomers

Links to Physics:

Links to Biology: How a skunk's defensive mechanism works

Good Stories: Tells how a researcher discovered an effective way to remove the odor from an animal that had been sprayed by a skunk.

Activity Description: Article discusses the structure of the odoriferous chemicals contained in skunk spray, a mixture that can effectively remove the odor, and the chemistry that explains how and why it works.

Number and Topic: 8. Chemical Reactions
20. Acids/Bases/pH
Source: *ChemMatters*, April 1996, pp. 4-5, "Leavening: How Great Cooks Loaf"
Type of Material: Student Journal Article
Building on: Chemical Reactions
Leading to: Acid-base chemistry
Links to Physics:
Links to Biology: Fermentation
Good Stories:
Activity Description: Article discusses the chemistry involved in the leavening of dough. It discusses both biological and chemical leavening and goes into the different types of chemical reactions that might be involved.

Number and Topic: 8. Chemical Reactions
18. Reaction Rates and Kinetics
Source: *ChemMatters*, April 1994, pp. 13-15, "Designer Catalysts"
Type of Material: Student Journal Article
Building on: Chemical reactions
Leading to: Discussion of catalysis and catalysts, activation energy
Links to Physics:
Links to Biology: Enzymes
Good Stories: Contains futuristic thoughts about possible new catalytic applications.
Activity Description: Article discusses catalysts, what they are, and how they operate in both chemical and biological systems.

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
10. Phases, Solids, Liquids and Gases (States of Matter)

Source: *ChemMatters*, Feb. 1993, pp. 12-15, "Saint's Blood"

Type of Material: Student Journal Article and Activity

Building on: Chemical Reactions, phases and phase changes

Leading to: Discussion of thixotropic mixtures and an activity designed to prepare one

Links to Physics:

Links to Biology:

Good Stories: Tells the story of Saint Januarius' feast in Naples, Italy, when a vial holding what is purported to be the clotted blood of Saint Januarius is displayed, moved and turns to a liquid.

Activity Description: The article explains why the "blood" is almost certainly not human blood, but rather a thixotropic mixture that can be prepared in the lab and probably was prepared by an early alchemist.

Number and Topic: 8. Chemical Reactions
19. Equilibrium

Source: *ChemMatters*, Dec. 1992, pp. 14-15, "When Good Ideas Gel"

Type of Material: Student Journal Article

Building on: Density, states of matter

Leading to: Equilibrium

Links to Physics: Density

Links to Biology:

Good Stories:

Activity Description: Article describes and discusses "aerogels," materials that look like sponges but have a density that is so low that they will float on soap bubbles of carbon dioxide.

- Number and Topic:** 8. Chemical Reactions
17. Water, Aqueous Solutions
20. Acids/Bases/pH
21. Organic Chemistry
- Source: *ChemMatters*, April 1992, pp. 12-15, "Wastewater"
- Type of Material: Student Journal Article
- Building on: Chemical reactions
- Leading to: Acids/Bases, pH
- Links to Physics:
- Links to Biology: Aerobic bacterial action
- Good Stories:
- Activity Description: Article describes how wastewater is treated and turned into potable water. Article goes into much specific chemistry and is well written by an expert in water treatment.
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- Number and Topic:** 8. Chemical Reactions
21. Organic Chemistry
- Source: *ChemMatters*, Dec. 1990, pp. 4-6, "Nylon"
- Type of Material: Student Journal Article
- Building on: Organic chemistry
- Leading to: Polymers
- Links to Physics:
- Links to Biology:
- Good Stories: Relates how Wallace Carothers and an assistant discovered nylon partly by insight, partly by luck.
- Activity Description: Article describes both the history of nylon, the chemical reactions involved in its creation, and the specific procedures by which a useful fiber is generated.
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- 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
21. Organic Chemistry

Source: *ChemMatters*, Feb. 1989, pp. 4-7, "Distance Running"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Organic chemistry, chemical and biological processes involved in human respiration and energy production

Links to Physics:

Links to Biology: Aerobic and anaerobic processes, function of ATP, glycogen, glucose, pyruvic acid and fats in producing energy within the human body

Good Stories:

Activity Description: Article deals with the chemistry and physiology of running.

Number and Topic: 8. Chemical Reactions
11. Thermochemistry
21. Organic Chemistry

Source: *ChemMatters*, Dec. 1988, pp. 13-15, "Fireside Dreams"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Combustion reactions

Links to Physics:

Links to Biology: Molecular structure of wood

Good Stories:

Activity Description: Article discusses the composition of wood, how and why it burns, and the chemical processes and reactions that are involved.

Number and Topic: 8. Chemical Reactions
9. Stoichiometry
12. Gases/Gas Laws/Kinetic Theory

Source: *ChemMatters*, April 1988, pp. 12-14, "The Exploding Tire"
Type of Material: Student Journal Article
Building on: Gas laws, chemical reactions
Leading to: Explosive mixtures
Links to Physics: Gas laws
Links to Biology:
Good Stories:
Activity Description: Article deals with a "mystery" explosion of a tire that was being repaired. It discusses how the use of a can of "instant flat tire fixer" was the cause of the explosion, and it goes into the specific chemical reactions involved as well as their stoichiometry.

Number and Topic: 8. Chemical Reactions
21. Organic Chemistry

Source: *ChemMatters*, Oct. 1987, pp. 12-15, "Dissolving Plastic"
Type of Material: Student Journal Article and Activity
Building on: Basic chemical knowledge
Leading to: Organic structures, polymers, solubility
Links to Physics:
Links to Biology:
Good Stories:
Activity Description: Article describes various types of plastic polymers and how it is possible to create a polymer (polyvinyl alcohol) that is soluble in water.

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: 8. Chemical Reactions
10. Phases, Solids, Liquids and Gases (States of Matter)
11. Thermochemistry
17. Water, Aqueous Solutions

Source: *ChemMatters*, Feb. 1987, pp. 7-11, "Hot and Cold Packs"

Type of Material: Student Journal Article and Activity

Building on: Chemical reactions

Leading to: Thermodynamics of the dissolving process

Links to Physics: Thermodynamics, heat, energy, entropy

Links to Biology:

Good Stories:

Activity Description: Article discusses both "hot packs" and "cold packs" and how they utilize both chemical reactions and simple crystallization to either release heat or absorb heat from their surroundings.

Number and Topic: 8. Chemical Reactions

Source: *ChemMatters*, Dec. 1986, pp. 13-15, "Going Against the Flow: The Isolation of Fluorine"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Redox, electrochemical cells, electrolysis

Links to Physics:

Links to Biology: Biological effects of exposure to hydrogen fluoride

Good Stories:

Activity Description: Article details historical attempts to prepare fluorine, including the high number of failures and the chemical reasons for these failures. There is a lot of basic chemistry involved in these attempts, and several early chemists suffered severe health problems and even death due to their attempts to work with highly toxic fluorine compounds.

Number and Topic: 8. Chemical Reactions
21. Organic Chemistry

Source: *ChemMatters*, April 1986, pp. 4-7, "Polymers"

Type of Material: Student Journal Article

Building on: Chemical reactions

Leading to: Organic reactions and the creation of polymers

Links to Physics:

Links to Biology: How the creation of plastic materials helped save the world's elephants from extinction due to poaching to obtain their tusks for the purpose of making billiard balls.

Good Stories: See above

Activity Description: The article details the creation of several different types of polymeric materials. It presents many of the equations involved in their synthesis and details about many of the processes, for example how a PET bottle is made.

Number and Topic: 8. Chemical Reactions
16. Covalent Bonds, Molecular Shapes and Intermolecular Forces
17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Feb. 1985, pp. 4-7, p. 12, "Soap"
Type of Material: Student Journal Article and Activity
Building on: Basic chemical knowledge of structures
Leading to: Polarity, intermolecular forces, "like dissolves like," saponification

Links to Physics:

Links to Biology:

Good Stories:

Early bathing habits. Queen Isabella of Spain boasted of taking only two baths in her lifetime, once when she was born and another on her wedding day. Queen Elizabeth I of England was a "bathing enthusiast." Her chronicles record that "she hath a bath every three months whether she needeth it or no."

Activity Description:

This article presents both the history of soap making, the science of soap making, including typical chemical equations, and the "art" of soapmaking. On page 12 there is a student activity relating to how soap works.

Number and Topic: 8. Chemical Reactions

Source: *ChemMatters*, Oct. 1984, pp. 4-5, "The Interrupted Party"

Type of Material: Student Journal Article

Building on: Basic chemical knowledge

Leading to: Requirements for combustion

Links to Physics:

Links to Biology:

Good Stories:

The "mystery" surrounding the serious burning (and eventual death) of a person who added lighter fluid to a barbeque that he thought had gone out. The reason for the resulting explosion is not as simple as one might assume.

Activity Description:

See above. The article discusses the specific requirements for combustion and how these are related to the terrible accident that occurred.

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

Source: *ChemMatters*, 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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Activity: Carbon Dioxide: A Pourable Greenhouse Gas
Activity: Dissolving Plastic
Activity: Hot and Cold Packs
Activity: Iron for Breakfast
Activity: Saint's Blood
Activity: Soap
Demo: Buffer Balancing Acts
Demo: The Cool [Endothermic] Reaction
Demo: Flameless Ration Heaters - Applied Chemistry
Demo: Periodic Activity of Metals
Demo: The Pink Catalyst
Demo: The Rainbow Tube
Demo: Safe Swimming with Sodium
Demo: Stoichiometry and Solubility - Mole Ratios and Chemical Formulas
Demo: Stoichiometry Balloon Race - Limiting and Excess Reagents
Demo: Strong vs. Weak Acids
Demo: Sudsy Kinetics - Old Foamey
Demo: Upset Tummy? MOM to the Rescue - Colorful Antacid
Demo: Whoosh Bottle Reaction
Demo: Underwater Fireworks
Demo: Collecting Gases by Water Displacement
Demo: Nails for Breakfast—Food Additive Demonstration
Demo: Iodized Salt—Food Additive Demonstration
Lab: All in the Family - The Halogens and Their Compounds
Lab: Buffers Keep the Balance - Biological Buffers
Lab: Classic Titration - pH Curves and an Unknown
Lab: Decomposition of Sodium Chlorate - Mass, Moles and the Chemical Equation
Lab: Oxygen - What a Flame—Microscale Gas Chemistry
Lab: Common Gases—Physical and Chemical Properties
Lab: Heats of Reaction and Hess's Law - Small-Scale Calorimetry
Lab: Identifying Chemical Activity
Lab: Measuring Acid Strength - K_a Values of Weak Acids
Lab: Measuring Calories - Energy Content of Food
Lab: Micro Mole Rockets - Hydrogen and Oxygen Mole Ratio
Lab: Microscale Titration Percent Acetic Acid in Vinegar
Lab: Mole Ratios - Copper and Silver Nitrate
Lab: Periodic Trends and the Properties of Elements - Alkaline Earth Metals
Lab: The Nature of a Chemical Reaction
Lab: Preparing and Testing Hydrogen Gas—A Microscale Approach
Lab: Carbon Dioxide - What a Gas—Microscale Gas Chemistry
Lab: Molar Volume of Hydrogen—Combining the Gas Laws
Lab: Food Testing Lab—Carbohydrates, Proteins, and Fats
Lab: Milk Is a Natural—Biology, Chemistry, and Nutrition
Lab: Vitamin C Analysis—Fruits and Fruit Juices
Lab: Total Acidity—Titration of Fruit Juices

ICE LABS

Online Descriptions and Experiments

Number and Topic: 8. Chemical Reactions
Source: ICE Laboratory Leadership
Type of Material: Lab 1 Cu Again! - A Copper Cycle
Building on: 1. Matter and change. 11. Thermochemistry
Leading to: 6. Chemical names and formulas.
9. Stoichiometry;
Links to Physics: Energy
Good Stories: Smelting of metals, alchemists.
Activity Description: Chemical reactions are often accompanied by formation of a precipitate, evolution of gas, change in color, or pronounced temperature change. In this activity, you will observe these characteristics of chemical reactions. Enjoy the variety!

Number and Topic: 8. Chemical Reactions
Source: ICE Laboratory Leadership
Type of Material: Lab 2. The Nature of a Chemical Reaction
Building on: 1. Matter and change
Leading to: 17. Water and aqueous solutions.
11. Thermochemistry.
Links to Physics: Energy, energy transformation
Links to Biology: Poisons, enzymes.
Good Stories: Did the Romans poison themselves with the lead they used for pipes and containers?
Activity Description: Changes go on about you all the time. Some changes are chemical changes, such as gasoline burning or a nail rusting. But what is happening when a chemical change occurs? What is the nature of a chemical reaction? To examine the behavior of matter in a chemical reaction, focusing on the behavior of the individual particles of each substance involved.

Number and Topic:	8. Chemical Reactions 14. Periodicity
Source:	ICE Laboratory Leadership
Type of Material:	Lab 8. Identifying Chemical Activity
Building on:	9. Stoichiometry
Leading to:	15. Ionic and metallic bonds
Links to Physics:	Statics
Links to Biology:	Some metals are more appropriate than others for biological use (as insulin pumps, etc.)
Good Stories:	“Sacrificial” metals are often attached to iron or steel underground structures.
Activity Description:	To determine the relative reactivity of several metallic elements. “Silver and Gold Coins Recovered from Ocean Shipwreck” is a possible news headline, while “Iron Coins Recovered...” would be less likely to appear. The difference in reactivity among metals is very important in selecting building materials and the types of products we use.

Technology-Adapted Labs

No activities for this topic.