

ARISE Curriculum Guide

Chemistry: Topic 17—Water, Aqueous Solutions

ChemMatters

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Articles for Student Use

- The Absorbing Story of the Thirsty Polymer: Oct. 1999, pp. 4-5.
Antifreeze Antidote: Oct. 1996, pp. 4-6.
Aquarium Chemistry: Feb. 2002, pp. 6-7.
An Atomic Tour: Oct. 1983, pp. 4-7.
The Case of the Missing Caffeine: April 1999, pp. 12-13.
Caves: Chemistry Goes Underground: April 2002, pp. 7-9.
Detergents: April 1985, pp. 4-6.
Embalming—Chemistry for Eternity: Oct. 1999, pp. 12-13,
Filtered Water vs. Straight from the Tap: Oct. 2002, pp. 8-9.
The Fizz-Keeper: Does it Really Keep the Fizz? Feb. 2002, pp. 11-13.
Homeopathy: Dec. 1991, pp. 8-11.
Hot and Cold Packs: Feb. 1987, pp. 7-11.
How Many Ways Can You See Red? Dec. 1999, p. 8.
Hydrogen Beer: Feb. 2002, p. 2.
Ice that Burns: Oct. 1995, pp. 8-11.
Iron for Breakfast: Oct. 1994, pp. 13-15.
Is Water the Best Fire Extinguisher in the Kitchen? April 2001, p. 2.
The Lake Nyos Disaster: Feb. 1996, pp. 13-15.
Kidney Dialysis. A Working Model You Can Make: April 2001, p. 12.
Laundry Disks: Miracle or Money Down the Drain? April 1997, pp. 14-15.
Lava Lite: A Chemical Juggling Act: April 1997, pp. 4-7.
Making Ice Cream: Dec. 1995, pp. 4-7.
Maple Syrup. Sweet Sap Boils Down to This: Feb. 2002, pp. 8-9.
Microwaves: Dec. 1993, pp.6-9.
Peanut Brittle: Dec. 1991, pp. 4-7.
Perfume: Feb. 1992, pp. 8-11.
Polywater: Dec. 1987, pp. 10-13.
Question from the Classroom: Oct. 2002, p. 2.
Scuba: The Chemistry of an Adventure: Feb. 2001, pp. 7-9.
The Search for Martian Water: Oct. 2002, pp. 12-13.
Soap: Feb. 1985, pp. 4-7, p. 12.
Sports Drinks: Don't Sweat the Small Stuff: Feb. 1999, pp. 11-13.
Super Soakers. Just How Super Are They? Oct. 1999, p. 6.
Survival at Sea: Oct. 1992, pp.4-7.
Swimming Pools: April 1994, pp. 10-12.
Tapping Saltwater for a Thirsty World: Oct. 2002, pp. 4-7.
Urine: Your Own Chemistry: Oct. 2002, pp. 14-45.

Wastewater: April 1992, pp. 12-15.

Why Do Eggs take Longer to Cook in the Mountains? Feb. 2000, p. 16.

Articles for Teacher Use

- Number and Topic:** 1. Matter and Change
17. Water, Aqueous Solutions
- Source:** *ChemMatters*, Oct. 2002, pp. 4-7, "Tapping Saltwater for a Thirsty World"
- Type of Material:** Student Journal Article
- Building on:** Classification of matter, water, aqueous solutions
- Leading to:** Colligative properties, osmosis
- Links to Physics:** Matter, energy
- Links to Biology:** Cells
- Good Stories:**
- Activity Description:** Article describes different attempts to obtain potable water from saltwater, including reverse osmosis and distillation.
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- Number and Topic:** 1. Matter and Change (Classification of Matter)
10. Phases, Solids, Liquids and Gases (States of Matter)
16. Covalent Bonds, Molecular Shapes and Intermolecular Forces,
17. Water, Aqueous Solutions
- Source:** *ChemMatters*, Dec. 1987, pp. 10-13, "Polywater"
- Type of Material:** Student Journal Article
- Building on:** Basic properties of water
- Leading to:** Discovery of "polywater" and how its existence was disproved
- Links to Physics:** Density, spectra
- Links to Biology:**
- Good Stories:** Entire article is a "good story."
- Activity Description:** This article relates the story behind the discovery of "polywater." It goes into the evidence for its existence, the excitement and hype that accompanied its reported discovery, the enthusiastic acceptance of its existence by some scientists versus the skepticism of others, and how its existence was eventually disproved. Although the article contains a lot of science content and information about the properties of water, its greatest value may very well lie in its exposition of the fact that at times science may take a wrong turn; it includes self-correcting features that work strongly towards correcting errors and arriving at the truth.

Number and Topic: 2. Measurement
3. Problem Solving
17. Water, Aqueous Solutions
20. Acids/Bases/pH
21. Organic Chemistry

Source: *ChemMatters*, April 1994, pp. 10-12, "Swimming Pools"

Type of Material: Student Journal Article

Building on: Quantitative calculations, ppm

Leading to: Acids, bases, pH, organic chemistry

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: Article discusses the chemistry involved in keeping a swimming pool clean and safe. It does a good job of illustrating the complexity of the trying to balance different requirements that are often in conflict.

Number and Topic: 3. Problem Solving
7. Moles
17. Water, Aqueous Solutions

Source: *ChemMatters*, Dec. 1991, pp. 8-11, "Homeopathy"

Type of Material: Student Journal Article

Building on: Problem solving, solutions

Leading to: Serial dilutions, process of science

Links to Physics:

Links to Biology: Placebo effect

Good Stories:

Activity Description: Article describes the notion of "Homeopathy," or the use of what are basically infinitely diluted solutions to treat illnesses. While the article contains a lot of good information relating to dilutions, etc., its major value probably lies in its exposition of what constitutes "good science" vs. the claims of pseudoscientific arguments and "scientific experiments" of questionable design.

Number and Topic: 4. Atomic Structure
6. Chemical Names and Formulas/Compounds and Elements
10. Phases, Solids, Liquids and Gases (States of Matter)
12. Gases/Gas Laws/Kinetic Theory
16. Covalent Bonds, Molecular Shapes and Intermolecular Forces
17. Water, Aqueous Solutions

Source: *ChemMatters*, Oct. 1983, pp. 4-7, "An Atomic Tour"
Type of Material: Student Journal Article
Building on: Basic knowledge of atomic and molecular structures
Leading to: Modeling, molecular motions, Boltzmann's distribution, composition of air, structure of water, polarity, hydrogen bonds, structure of ice

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: This article, written by the late Isaac Asimov, takes the reader on an imaginary journey where he/she becomes smaller and smaller until he/she can see individual atoms and molecules. The article goes on to describe several molecular structures and motions.

Number and Topic: 6. Chemical Names and Formulas/Compounds and Elements
10. Phases, Solids, Liquids and Gases (States of Matter)
17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Dec. 1995, pp. 4-7, "Making Ice Cream"
Type of Material: Student Journal Article and Activity
Building on: Basic chemical knowledge of molecular structures
Leading to: Colloids, lipids, emulsifiers, sugars, colligative properties

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: Food, lipids, proteins
Relates the history of ice cream and some government regulations regarding the labeling of the product.
Article discusses the composition of ice cream and the science behind its preparation and ends with a student activity to make home-made ice cream.

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
17. Water, Aqueous Solutions
20. Acids/Bases/pH
21. Organic Chemistry

Source: *ChemMatters*, April 1985, pp. 4-6, "Detergents"

Type of Material: Student Journal Article

Building on: Basic knowledge of molecular structures and ions

Leading to: Discussion of anionics, cationics, nonionics, emulsions, micelles, hard water

Links to Physics:

Links to Biology: Eutrophication caused by the presence of phosphates in detergents, bacterial action on surfactants

Good Stories:

Activity Description: Article discusses detergents, what they contain, the function of each ingredient and how they are different from soaps.

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
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
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.

Number and Topic: 10. Phases, Solids, Liquids and Gases (States of Matter)
17. Water, Aqueous Solutions

Source: *ChemMatters*, Feb. 2002, pp. 8-9, "Maple Syrup. Sweet Sap Boils Down to This"

Type of Material: Student Journal Article

Building on: Phases, phase changes

Leading to: Colligative properties, boiling points vs. concentration

Links to Physics: Matter, energy

Links to Biology: Plants, photosynthesis, food, energy flow

Good Stories:

Activity Description: Article describes how maple syrup is made. It elucidates the science involved along with why maple syrup comes in different grades and how the grade is related to how rapidly and at what temperature the sap is evaporated and the point at which the syrup is harvested from the evaporating sap.

Number and Topic: 10. Phases, Solids, Liquids and Gases (States of Matter)
17. Water, Aqueous Solutions

Source: *ChemMatters*, Feb. 2002, pp. 11-13, "The Fizz-Keeper: Does it Really Keep the Fizz?"

Type of Material: Student Journal Article and Activities

Building on: Gases, Water, aqueous solutions

Leading to: Gas solubility, Henry's Law

Links to Physics:

Links to Biology:

Good Stories: Commercial products often make invalid claims based upon questionable science

Activity Description: A commercial product called a "Fizz-Keeper" claims to be able to keep opened bottle of carbonated beverages from going flat. It basically doesn't work, and the article clearly goes through the scientific principles that explain why it wouldn't be expected to work. The article also contains some student activities.

Number and Topic: 10. Phases, Solids, Liquids and Gases (States of Matter)
12 Gases/Gas Laws/Kinetic Theory
17. Water, Aqueous Solutions

Source: *ChemMatters*, Feb. 2001, pp. 7-9, "Scuba: The Chemistry of an Adventure"

Type of Material: Student Journal Article

Building on: States of matter, density, gases, water

Leading to: Heat capacity, refraction, Henry's Law

Links to Physics: Refraction, motion and forces

Links to Biology: Ecosystems

Good Stories: Author relates her personal experiences while learning how to Scuba dive.

Activity Description: Article relates the author's experiences while Scuba diving and then tries to explain the scientific reasons behind the phenomena, for example, why submerged objects appear to be closer or why colors fade.

Number and Topic: 10. Phases, Solids, Liquids and Gases (States of Matter)
17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, April 1999, pp. 12-13, "The Case of the Missing Caffeine"

Type of Material: Student Journal Article

Building on: Phases, organic chemistry, aqueous solutions

Leading to: Phase diagrams

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: Article discusses caffeine, its structure and presence in various beverages. It goes on to explain different methods by which caffeine can be extracted from a beverage. This leads to a discussion of the phase diagram of carbon dioxide and what is meant by the term "supercritical" fluid.

- Number and Topic:** 12. Gases/Gas Laws/Kinetic Theory
17. Water, Aqueous Solutions
- Source: *ChemMatters*, Feb. 2002, p. 2, "Hydrogen Beer"
- Type of Material: Student Journal Article
- Building on: Elements
- Leading to: Gases, solubility, Henry's Law
- Links to Physics:
- Links to Biology:
- Good Stories: The entire article is a great "story."
- Activity Description: Terrific story about "hydrogen beer," a beer said to contain hydrogen gas rather than carbon dioxide. Hydrogen beer is a hoax, an "urban legend" but was actually able to fool enough educated people so that it made it to a reputable physics Website as well as a chemistry textbook. Applying simple notions of solubility, etc., should have revealed its obvious nonvalidity.
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- Number and Topic:** 12. Gases/Gas Laws/Kinetic Theory
17. Water, Aqueous Solution
18. Reaction Rates and Kinetics
- Source: *ChemMatters*, Feb. 2000, p. 16, "Why Do Eggs take Longer to Cook in the Mountains?"
- Type of Material: Student Journal Article including a fun quiz
- Building on: Gases
- Leading to: Colligative properties of solutions
- Links to Physics: Heat, energy
- Links to Biology: Coagulation of proteins
- Good Stories: There is a "fun" quiz at the end of the article.
- Activity Description: Article discusses how pressure varies with altitude and how this affects the boiling point of water, which in turn affects the time required to hard boil an egg.
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- Number and Topic:** 12. Gases/Gas Laws/Kinetic Theory
17. Water, Aqueous Solutions
- Source: *ChemMatters*, Feb. 1996, pp. 13-15, "The Lake Nyos Disaster"
- Type of Material: Student Journal Article
- Building on: Gases
- Leading to: Water, aqueous solutions
- Links to Physics:
- Links to Biology:
- Good Stories: On August 21, 1986, a cloud of carbon dioxide was released from Lake Nyos in Cameroon, West Africa, killing 1,724 people and several thousand animals.
- Activity Description: Article explains how carbon dioxide accumulated in Lake Nyos over a period of years, why it remained in the lake at high concentrations, and what probably caused it to be rapidly released, resulting in the disaster.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 2002. p. 2, "Question from the Classroom"
Type of Material: Student Journal Article
Building on: Chemical formulas, matter and change
Leading to: General critical thinking
Links to Physics: Matter
Links to Biology: Ecosystems, resources and environmental issues
Good Stories: Entire article is a "good story."
Activity Description: Article deals with "plans to ban DHMO, one of the most hazardous substances on the planet." A long list of terrible human and environmental consequences caused by the widespread presence of DHMO is presented. All are technically accurate. DHMO turns out to be dihydrogen monoxide, common water!

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 2002, pp. 8-9, "Filtered Water vs. Straight from the Tap"
Type of Material: Activity
Building on: Matter and Change, Chemical Reactions, States of Matter
Leading to: Equilibrium
Links to Physics: Matter, energy
Links to Biology: Cells,
Good Stories:
Activity Description: Detailed laboratory directions for comparing filtered (or distilled) water to tap water for appearance, smell, hardness, calcium, iron and chlorine. Somewhat similar to Lab B7, pp. 35-38 in the 4th edition of the ChemCom textbook.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 2002, pp. 12-13, "The Search for Martian Water"
Type of Material: Student Journal Article
Building on: Matter and change, states of matter, electromagnetic spectrum
Leading to: Remote sensing of molecules
Links to Physics: Electromagnetic spectrum
Links to Biology: Cells, evolution, ecosystems
Good Stories: Article is a good story about how water is detected from a distance and the possible significance of its presence.
Activity Description: Article describes how the NASA Odyssey project has detected the presence of water on Mars, the techniques by which this is accomplished, and the possible significance of this discovery.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 2002, pp. 14-45, "Urine: Your Own Chemistry"
Type of Material: Student Journal Article
Building on: Water, aqueous solutions
Leading to: Organic chemistry, acids/bases/ pH
Links to Physics:
Links to Biology: Living matter, food, energy flow, cells, organisms
Good Stories: Article contains some interesting tidbits, like why does your urine smell funny after eating asparagus, and why is it bright yellow if you take vitamin pills containing riboflavin (vitamin B2).
Activity Description: This article obviously deals with urine, what it is and what it contains.

Number and Topic: 17. Water, Aqueous Solutions
19. Equilibrium
Source: *ChemMatters*, Feb. 2002, pp. 6-7, "Aquarium Chemistry"
Type of Material: Student Journal Article
Building on: Water, aqueous solutions, gas solubility
Leading to: Equilibrium, pH, buffer solutions
Links to Physics: Refractive index
Links to Biology: Ecosystems, respiration, bacteria
Good Stories: Features some real professional aquarists along with students
Activity Description: Compares problems that professional keepers of large public aquariums must contend with to similar problems involved in maintaining a home aquarium.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, April 2001, p. 12, "Kidney Dialysis. A Working Model You Can Make"
Type of Material: Activity
Building on: Water, properties of solutions, Kinetic theory
Leading to: Osmosis
Links to Physics: Measurement, kinetic theory
Links to Biology: Connects to cells and the transport of materials through membranes
Good Stories: None
Activity Description: This activity uses a simple zip-closing-type bag and a simple solution of tincture of iodine to demonstrate the movement of materials through membranes. It is actually connected to an article on kidney dialysis that appears in the same issue.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Dec. 1999, p. 8, “How Many Ways Can You See Red?”
Type of Material: Activity
Building on: Water, aqueous solutions
Leading to: Chromatography
Links to Physics:
Links to Biology:
Good Stories:
Activity Description: Students do a simple paper chromatography experiment with different red candies, such as red M&Ms or Skittles to determine how many different kinds of red food dye they contain. They compare their results to what is reported on the package label.

Number and Topic: 17. Water, Aqueous Solutions
21. Organic Chemistry
Source: *ChemMatters*, Oct. 1999, pp. 4-5, “The Absorbing Story of the Thirsty Polymer”
Type of Material: Student Journal Article
Building on: Water, aqueous solutions
Leading to: Solvation, polymers
Links to Physics:
Links to Biology:
Good Stories:
Activity Description: Discusses how super-absorbing polyacrylate polymers work.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 1999, p. 6, “Super Soakers. Just How Super Are They?”
Type of Material: Activity
Building on: Water, Aqueous solutions
Leading to: Polymers
Links to Physics:
Links to Biology:
Good Stories:
Activity Description: Activity has students compare the water-absorbing ability of a paper towel alone and when some polyacrylate material has been added to it.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 1999, pp. 12-13, “Embalming—Chemistry for Eternity”
Type of Material: Student Journal Article
Building on: Water, aqueous solutions
Leading to: Organic chemistry
Links to Physics:
Links to Biology: Cells
Good Stories: Relates embalming practices from ancient Egyptians to modern times.
Activity Description: Article discusses how ancient Egyptians embalmed bodies, focusing on the chemistry involved. Moves on to modern embalming techniques using organic chemicals such as formaldehyde.

Number and Topic: 17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Feb. 1999, pp. 11-13, "Sports Drinks: Don't Sweat the Small Stuff"

Type of Material: Student Journal Article

Building on: Water, aqueous solutions

Leading to: pH, organic chemistry

Links to Physics:

Links to Biology: Cells, Food

Good Stories: Presents the results of scientific research into the physiological value of sports drinks.

Activity Description: Article discusses sports drinks such as Gatorade—what they are, what they provide, the rationale that underlies their formulation and the results of scientific studies regarding their effectiveness compared to pure water.

Number and Topic: 17. Water, Aqueous Solutions

Source: *ChemMatters*, April 1997, pp. 14-15, "Laundry Disks: Miracle or Money Down the Drain?"

Type of Material: Student Journal Article

Building on: Several chemical concepts relating to molecular structures, heat, and ions

Leading to: An evaluation of the claims made by a producer of "Laundry Disks"

Links to Physics: Electromagnetic spectrum

Links to Biology:

Good Stories: Explains why the scientific claims made by a manufacturer of laundry disks are erroneous and misleading.

Activity Description: Article lists the claims made by a manufacturer of laundry disks—that they can be used for 500-700 loads without having to add anything to them - and why these claims are scientific nonsense.

Number and Topic: 17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Oct. 1996, pp. 4-6, "Antifreeze Antidote"

Type of Material: Student Journal Article

Building on: Aqueous solutions

Leading to: Organic structures, colligative properties (freezing point depression)

Links to Physics:

Links to Biology: Discusses effect of ethylene glycol on organs such as the brain and kidneys.

Good Stories: Relates the incredible number of animal and human deaths that occur each year due to the ingestion of ethylene glycol antifreeze. Interestingly, the antidote for ethylene glycol poisoning is ethyl alcohol!

Activity Description: Discusses the structure of ethylene glycol and how it functions as an antifreeze. Goes on to relate its devastating biological effects if ingested and then presents safer alternatives.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 1995. pp. 8-11, "Ice that Burns"
Type of Material: Student Journal Article
Building on: Solids, liquids and gases
Leading to: Properties of methane, global warming
Links to Physics:
Links to Biology:
Good Stories:
Activity Description: Article discusses the phenomenon of "gas hydrates," which are ice crystals that trap methane gas and are typically found at the bottom of oceans.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Dec. 1993, pp.6-9, "Microwaves"
Type of Material: Student Journal Article
Building on: Electromagnetic spectrum, molecular polarity
Leading to: Molecular motions (rotation of molecules)
Links to Physics: Electromagnetic spectrum
Links to Biology: Organic structures found in foods
Good Stories: Exposes many of the common myths that surround microwave ovens (they cause cancer), but at the same time explains some things that might be surprising to both us and our students, such as the fact that some people can hear microwaves and the fact that they can turn low-grade oil into high-grade oil.
Activity Description: Article discusses what microwaves are, how a microwave oven works, how microwaves manage to heat food, and why microwaves interact with polar molecules.

Number and Topic: 17. Water, Aqueous Solutions
Source: *ChemMatters*, Oct. 1992, pp.4-7, "Survival at Sea"
Type of Material: Student Journal Article
Building on: Water and solutions
Leading to: Osmosis, reverse osmosis
Links to Physics:
Links to Biology: Discusses the role of water in the human body and the effects of lack of water on human physiology.
Good Stories: Relates the story of the ship the HMS Bounty, and explains how Captain Bligh and all but one of 18 loyal sailors managed to survive 48 days at sea after the mutiny.
Activity Description: Article discusses the role of water on human physiology and how pure water can be obtained from sea water by utilizing reverse osmosis.

Number and Topic: 17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Feb. 1992, pp. 8-11, "Perfume"

Type of Material: Student Journal Article

Building on: Solutions

Leading to: Solubility—"like dissolves like"

Links to Physics:

Links to Biology: How odors and other types of sensory input are interpreted by the human brain.

Good Stories: History of perfumes and how much of the cost of a typical perfume actually is related to the perfume itself and how much is related to packaging and advertising.

Activity Description: Article describes the history of perfumes, what they contain, and how they are typically prepared.

Number and Topic: 17. Water, Aqueous Solutions
21. Organic Chemistry

Source: *ChemMatters*, Dec. 1991, pp. 4-7, "Peanut Brittle"

Type of Material: Student Journal Article and Activity

Building on: Chemical Reactions, Solubility

Leading to: Supersaturated solutions, amorphous solids, organic compounds and reactions

Links to Physics:

Links to Biology:

Good Stories:

Activity Description: Article describes what peanut brittle is, how it is made, the chemical reactions involved, and its structure. After the formal article there is a student activity to make peanut brittle.

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

Source: *ChemMatters*, April 1997, pp. 4-7, "Lava Lite: A Chemical Juggling Act"

Type of Material: Student Journal Article

Building on: Polar and nonpolar bonds and compounds, "like dissolves like"

Leading to: Organic molecules and their structures

Links to Physics:

Links to Biology:

Good Stories: Tells story of the invention of the lava lamp and its high popularity during the "Age of Aquarius" 1960s. A highly guarded secret, the composition of the materials inside the lamp were determined when an alcoholic drank a lamp's contents and the composition of the contents needed to be ascertained in order to save the man's life.

Activity Description: Article describes the structure of lava lamps and how their operation is related to the molecular structures and densities of the materials inside the lamp.

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: 17. Water, Aqueous Solutions
Source: ICE Laboratory Leadership
Type of Material: Lab 9. The Ion Exchange (Which Salts are Soluble?)
Building on: 8. Chemical reactions
Leading to: 14. Periodicity
Links to Physics: Energy
Links to Biology: Many ions which are soluble in water can affect biological systems. Examples are heavy metals in water, which can have deleterious effects, and fluoride in water, which can have variable effects depending on its concentration.
Good Stories: Boilers can blow up if ‘hard water’ causes the circulating system to clog up.
Activity Description: To determine which ions react to produce precipitates by analyzing data regarding mixtures of ionic compounds. What do stalagmites and stalactites found in caverns have in common with the deposits found on old water faucets? How were many minerals, now mined as ores, originally formed? The answers to both questions can be found in a study of precipitates. If a positive ion (cation) of a dissolved salt reacts with the negative ion (anion) of a different compound to form a new salt with low solubility, chemists say that a precipitate has formed.

Technology-Adapted Labs

Number and Topic:	17. Water, Aqueous Solutions
Source:	<i>ChemCom</i> , fourth Edition, Unit I, p.3. Bill Grosser, Glenbard South High School
Type of Material:	Lab: Water Quality
Building on:	Solubility of solids and gases, aqueous solutions, applied chemistry
Links to Physics:	Behavior of particles in complex systems
Links to Biology:	Ecology of ecosystems
Good stories:	Water testing is a ripe field for stories of fish kills. A quick search on the Internet for “fish kills” can produce many dramatic stories to share with the kids.
Activity Description:	The first unit in the <i>ChemCom</i> textbook focuses on a hypothetical fish kill. Students determine what killed the fish after learning how to do a number of water analysis tests. This approach is enhanced by incorporating the use of the Water Quality Index, a standardized series of nine tests that produces a quantitative value for the overall quality of water in a stream or lake.
Problem/Project Based Learning:	This is a very good applied-chemistry project for the students. Discussing the results of the tests often leads to numerous open ended questions.