1	A Refrigerator Magnet Analog of Scanning-Probe Microscopy. Julie K. Lorenz, Joel A. Olson, Dean J. Campbell, George C. Lisensky, and Arthur B. Ellis. Journal of Chemical Education 1997 74 (9), 1032A–1032B.	http://pubs.acs.org/doi/abs/10.1021/ed074p1032A	In this Activity, students investigate the magnetic interactions between a flexible-sheet refrigerator magnet and a probe tip cut from the same magnet to deduce the relative arrangement of the magnetic poles. These interactions are used as a macroscopic analog of scanning probe microscopies. The Activity could be used when atoms are introduced. It helps students understand how atomic-scale images are obtained.
2	Anthocyanins: A Colorful Class of Compounds. JCE Staff. Journal of Chemical Education 1997 74 (10), 1176A.	http://pubs.acs.org/doi/abs/10.1021/ed074p1176A	In this Activity, students extract anthocyanins from flower petals and other plant matter. They observe what happens when vinegar or ammonia are added to the extracts. This Activity could be used as an introduction to the study of plant pigments and the idea that specific substances are responsible for the colors of objects. It could also relate to acid-base indicators, the pH scale, and titration.
3	How Big Is the Balloon? Stoichiometry Using Baking Soda and Vinegar. JCE Staff. Journal of Chemical Education 1997 74 (11), 1328A.	http://pubs.acs.org/doi/abs/10.1021/ed074p1328A	In this Activity, students discover the concept of stoichiometry and limiting reactants in two ways: first by adding vinegar to a small quantity of baking soda until bubbles stop, and second by mixing a constant quantity of baking soda with increasing volumes of vinegar and collecting the carbon dioxide produced in balloons. This Activity could be used in an introduction to stoichiometry. It is also a simple example of an acid-base reaction. The inflation of the balloon could be discussed in relation to the ideal gas law.
4	Rain, Lakes, Streams: Investigating Acidity and Buffering Capacity in the Environment. Judith A. Halstead. Journal of Chemical Education 1997 74 (12), 1456A.	http://pubs.acs.org/doi/abs/10.1021/ed074p1456A	In this Activity, students test the pH and acid neutralizing capacity of plain water, water that they blow their breath into, and water with either baking soda or lemon juice added. Students discover why normal rain is not neutral when they observe the effect of their breath on the pH of poorly buffered water. The observation that clean, natural rain is not neutral can be used as an example of equilibrium or to introduce weak acids. The primary concept introduced by this Activity is that of buffering capacity.

5	An Activity with Electricity. JCE Staff. Journal of Chemical Education 1998 75 (1), 80A.	http://pubs.acs.org/doi/abs/10.1021/ed075p80A	In this Activity, students investigate static electricity. They observe that charged objects attract a narrow stream of water, and find that charged combs and glass rods have opposite charges. This Activity could be used to introduce the notion of positive and negative electric charge. It is appropriate when studying atomic theory, and when introducing electrochemistry. An application of static electric charge is xerography, the basis for photocopiers and laser printers.
6	On the Surface: Mini-Activities Exploring Surface Phenomena. JCE Staff. Journal of Chemical Education 1998 75 (2), 176A.	http://pubs.acs.org/doi/abs/10.1021/ed075p176A	In this Activity, students investigate surface tension and surfactants. They count the number of drops they can place on a penny, attempt to make a "square" of drops, and create bubbles using differently-shaped wands. These mini-activities could be used to introduce surface tension and surface area when discussing properties of liquids and gases.
7	How Many Colors in Your Computer? Discovering the Rules for Making Colors. JCE Staff. Journal of Chemical Education 1998 75 (3), 312A.	http://pubs.acs.org/doi/abs/10.1021/ed075p312A	In this Activity, students investigate the colors displayed on a computer monitor with a magnifying glass. Then then mix colors first using light, then using paints or crayons. This Activity could be used in discussions of solid state chemistry when LEDs, phosphors, or liquid crystals are discussed. It may also be appropriate when introducing spectroscopy because it deals with absorption and emission of colored light. It could also introduce a unit on practical applications of chemistry, such as the chemistry behind computers.
8	Spring Shock!: Impact of Spring Snowmelt on Lakes and Streams. Judith A. Halstead. Journal of Chemical Education 1998 75 (4), 400A.	http://pubs.acs.org/doi/abs/10.1021/ed075p400A	In this Activity, students investigate "spring shock", the flow of acidic water into lakes and streams that occurs during snowmelt in the spring. They freeze vinegar in ice cube trays, and then allow the cubes to melt at room temperature through a funnel. They collect the liquid and monitor its pH. This Activity could be used in units on environmental chemistry and water chemistry.

9	The Science Mentor: An Adventure in Chemistry Education. Amy Huseth. Journal of Chemical Education 1998 75 (5), 528A.	http://pubs.acs.org/doi/abs/10.1021/ed075p528A	In this Activity, students learn about a demonstration and activity that they could use with elementary students. The demonstration uses an effervescent antacid tablet such as Alka Seltzer with water to blow up a balloon. The activity also uses the tablet with water, this time in a film canister. The Activity provides background on instituting a science mentor program that connects high school students with elementary students.
10	Chemistry Time: Factors Affecting the Rate of a Chemical Reaction. JCE Staff. Journal of Chemical Education 1998 75 (9), 1120A.	http://pubs.acs.org/doi/abs/10.1021/ed075p1120A	In this Activity, students use effervescent antacid tablets such as Alka Seltzer, and baking soda and vinegar, to investigate factors that determine how fast chemical reactions occur. The Activity could be used to introduce a unit on chemical kinetics, but it is simple enough to be used in a discussion of chemical reactions or experimental methods/procedures during the first weeks of school.
11	What's Gluep? Characterizing a Cross-Linked Polymer. JCE Staff. Journal of Chemical Education 1998 75 (11), 1432A.	http://pubs.acs.org/doi/abs/10.1021/ed075p1432A	In this Activity, students make a cross-linked polymer called "gluep" using white glue and borax solution. They then investigate its properties, and "un-gluep" and "re-gluep" it using vinegar and baking soda. This Activity can be used in discussions of polymers or properties of liquids and solids. It demonstrates the composition and alternative use of a common household product.
12	CD Light: An Introduction to Spectroscopy. JCE Staff. Journal of Chemical Education 1998 75 (12), 1568A.	http://pubs.acs.org/doi/abs/10.1021/ed075p1568A	In this Activity, students use a CD to build a simple spectroscope. They use it to investigate how different colors of light interact with colored matter. This qualitative Activity could be used as a general introduction to spectroscopy and the concepts of complementary colors and absorbance. The student-constructed spectroscope could be used in an Activity studying line spectra from outdoor night lighting.

13	The Effects of Temperature on Lightsticks. JCE Staff. Journal of Chemical Education 1999 76 (1), 40A.	http://pubs.acs.org/doi/abs/10.1021/ed076p40A	In this Activity, students observe and compare the behavior of three lightsticks that are exposed to three different temperature ranges (cold, room temperature, and hot). The Activity could be used early in the school year to give students practice in making detailed observations and devising reasonable explanations for those observations. It illustrates the use of qualitative vs. quantitative observations. This Activity can also introduce a unit on chemical kinetics.
14	Soapmaking. JCE Staff. Journal of Chemical Education 1999 76 (2), 192A.	http://pubs.acs.org/doi/abs/10.1021/ed076p192A	In this Activity, students make soap using vegetable shortening as a base. They then test its properties and compare it to commercial soap. This Activity introduces students to an important reaction of organic chemistry. It helps students connect chemistry to something that they see and use every day and provides an opportunity for crosscurricular work. It could be connected to history or literature classes that discuss the lives of pioneers and homesteaders who often made their own household products. It also connects to industrial chemistry.
15	Liver and Onions: DNA Extraction from Animal and Plant Tissues. Karen J. Nordell, Anne-Marie L. Jackelen, S. Michael Condren, George C. Lisensky, and Arthur B. Ellis. Journal of Chemical Education 1999 76 (3), 400A.	http://pubs.acs.org/doi/abs/10.1021/ed076p400A	In this Activity, students extract DNA from liver and onion cells, and precipitate the DNA. The Activity fits well with a discussion of nucleic acids, hydrogen bonding, genetic coding, and heredity. DNA extraction can also be used in conjunction with a discussion of polymers and their properties. This Activity can be used to complement a diffraction experiment illustrating how the double helix structure of DNA was determined.

16	Chemical Methods for Developing Latent Fingerprints. Gurvinder S. Sodhi and Jasjeet Kaur. Journal of Chemical Education 1999 76 (4), 488A.	http://pubs.acs.org/doi/abs/10.1021/ed076p488A	In this Activity, students collect fingerprints and use three different methods to develop them: fingerprint powder, ninhydrin solution, and silver nitrate solution. The Activity could be related to the solubility of polar and nonpolar molecules, precipitation reactions, and oxidation-reduction reactions. The major organic and inorganic components of sweat can be discussed in a biochemistry course. The adhesion of fingerprints powders to constituents of sweat are a surface chemistry example of adsorption.
17	Soup or Salad? Investigating the Action of Enzymes in Fruit on Gelatin. Erica K. Jacobsen. Journal of Chemical Education 1999 76 (5), 624A.	http://pubs.acs.org/doi/abs/10.1021/ed076p624A	In this Activity, students observe gelatin samples treated with substances that may or may not have an enzymatic effect on the protein in the gelatin. Substances used are fresh pineapple, canned pineapple, fresh pineapple that has been frozen and microwaved, and meat tenderizer. This Activity introduces enzymes on a simpler, hands-on level and emphasizes the fact that we come into contact with chemistry on an everyday basis. The Activity also provides an entry point into the science of HIV. An HIV treatment uses proteases, a type of enzyme.
18	Photochemistry and Pinhole Photography: An Interdisciplinary Experiment. Angeliki A. Rigos and Kevin Salemme. Journal of Chemical Education 1999 76 (6), 736A.	http://pubs.acs.org/doi/abs/10.1021/ed076p736A	In this Activity, students use an oatmeal canister to make a pinhole camera, load it with black and white photographic paper, and create a paper negative using the camera. This interdisciplinary Activity combines chemistry and art. The reactions in black and white photography are good examples of photochemistry and multiphase chemical reactions, since the light sensitive materials (silver halides) are in the form of a gelatin emulsion of microscopic crystals.

19	Blueprint Photography by the Cyanotype Process. Glen D. Lawrence and Stuart Fishelson. Journal of Chemical Education 1999 76 (9), 1216A.	http://pubs.acs.org/doi/abs/10.1021/ed076p1216A	In this Activity, students prepare cyanotype paper and use it to "photograph" different items using sunlight. This Activity demonstrates catalysis of chemical reactions by ultraviolet (UV) light using one of the earliest photographic processes, the cyanotype process. It is useful as an introduction to the damaging effects of UV radiation on living organisms and the role of sunscreens.
20	Cleaning Up with Chemistry: Investigating the Action of Zeolite in Laundry Detergent. JCE Staff. Journal of Chemical Education 1999 76 (10), 1416A.	http://pubs.acs.org/doi/abs/10.1021/ed076p1416A	In this Activity, students extract sodium zeolite A from powdered laundry detergent and examine its properties. The Activity helps students to apply their chemical knowledge to the realm of consumer products. It could be used as a lead-in for a discussion of environmental issues and water chemistry. Zeolites are used in many other areas and can be incorporated into a discussion of industrial chemistry.
21	Hunting for Chemicals in Consumer Products. Arthur M. Last. Journal of Chemical Education 1999 76 (11), 1504A.	http://pubs.acs.org/doi/abs/10.1021/ed076p1504A	In this Activity, students use written clues to determine the identities of 12 chemical compounds. They write the name and chemical formula for each compound, and find a consumer product in which each compound is present. This Activity increases student awareness of the presence of a variety of chemical compounds in a range of common consumer products. It could be used as an end-of-year project or as an ongoing project throughout the school year.
22	Colors to Dye for: Preparation of Natural Dyes. JCE Staff. Journal of Chemical Education 1999 76 (12), 1688A.	http://pubs.acs.org/doi/abs/10.1021/ed076p1688A	In this Activity, students extract colored compounds from onion skins and blueberries, use them to dye white cloth, and investigate ways to change the color and prevent it from washing out. The Activity ties into the history of dyes. A study of the structures of dye molecules can be integrated into a discussion of organic chemistry and functional groups. Some natural dyes are acid-base indicators and can be incorporated into a section on acid-base chemistry. Discussion of mordants can be included in an introduction to metal complexes.

23	Magic Sand. JCE Staff. Journal of Chemical Education 2000 77 (1), 40A.	http://pubs.acs.org/doi/abs/10.1021/ed077p40A	In this Activity, students compare the behavior of Magic Sand and ordinary sand. They then predict and observe how new substances will interact with Magic Sand based on their observations. The Activity illustrates solubility principles, and the terms hydrophilic and hydrophobic. It also allows for extension into the practical realm, where students formulate real-world uses for Magic Sand.
24	The Write Stuff: Using Paper Chromatography to Separate an Ink Mixture. JCE Staff. Journal of Chemical Education 2000 77 (2), 176A.	http://pubs.acs.org/doi/abs/10.1021/ed077p176A	In this Activity, students perform a variation on the standard paper chromatography separation of black ink. They compare the separation of black ink using four different solvents: water, rubbing alcohol, vinegar, and household ammonia, and then mixtures of the four. It introduces students to methods of selecting the best solvent for a separation and the effects of adding acid and base. This Activity can lead to a discussion of mixtures and ways to separate their components. Capillary action, solute-solvent interaction, and differences in polarity and solubility are related topics.
25	Silver to Black—And Back. JCE Staff. Journal of Chemical Education 2000 77 (3), 328A.	http://pubs.acs.org/doi/abs/10.1021/ed077p328A	In this Activity, students remove tarnish from silver using the reaction of tarnish with aluminum. If only untarnished silver items are available, students first tarnish them using items that contain sulfur. This Activity could be used with topics such as chemical changes, metals, electrochemistry, and redox reactions. The Activity could introduce a discussion of silver and its reactions. The topic of silver and tarnish removal can also be used in other curriculum areas, such as home economics, photography, and art conservations and restoration.

26	Out of "Thin Air": Exploring Phase Changes. John J. Vollmer. Journal of Chemical Education 2000 77 (4), 488A.	http://pubs.acs.org/doi/abs/10.1021/ed077p488A	This Activity illustrates sublimation/deposition with *para*-dichlorobenzene (mothballs) and evaporation/condensation with water. This Activity could be used to introduce the phases of matter and phase changes at both the macroscopic and microscopic levels. For advanced students, the Activity could accompany a discussion of the thermodynamics of phase changes, calculations of enthalpies of sublimation and evaporation, and phase diagrams. It can also introduce crystals and their formation.
27	How Does Your Garden Grow? Investigating the "Magic Salt Crystal Garden". JCE Staff. Journal of Chemical Education 2000 77 (5), 624A.	http://pubs.acs.org/doi/abs/10.1021/ed077p624A	In this Activity, students investigate the chemistry of the popular "Salt Crystal Garden". They grow salt crystals by evaporation from aqueous solutions containing various mixtures of table salt, ammonia, and laundry bluing in order to determine the purpose of each component. This Activity can be used to introduce: separation of solute from solution by evaporation; crystal formation and growth; preparation of solutions of specific composition; experimental design; and chromatography. It could be used at the end of the school year as a review or application of topics covered in class.
28	More Than Meets the Eye: Nonvisual Observations in Chemistry. JCE Staff. Journal of Chemical Education 2000 77 (9), 1104A.	http://pubs.acs.org/doi/abs/10.1021/ed077p1104A	In this Activity, a blindfolded student, with another student as an assistant, observes the reaction between baking soda and cream of tartar in solution in a plastic bag. The Activity could be used at the start of a chemistry course to emphasize the importance of using all appropriate senses to make observations. The Activity could also be used to demonstrate examples of acid-base reactions, reactions of carbonates, or endothermic reactions. It also serves to sensitize both students and instructors to the topic of modifications for those with special needs.

29	Flat as a Pancake? Exploring Rising in Baked Goods. JCE Staff. Journal of Chemical Education 2000 77 (10), 1264A.	http://pubs.acs.org/doi/abs/10.1021/ed077p1264A	In this Activity, students investigate the action of leavening agents in baked goods. They first compare the results when leavening agents are added to water, with and without heating. They then prepare biscuits using dough that has been placed in different temperature environments and compare them. Preparing the biscuits requires an oven. The Activity could be used in a unit on acid-base chemistry, "everyday chemistry", food chemistry, or as a cross-curricular activity with a home economics class.
30	Cabbage Patch Chemistry. JCE Staff. Journal of Chemical Education 2000 77 (11), 1432A.	http://pubs.acs.org/doi/abs/10.1021/ed077p1432A	In this Activity, students investigate the fermentation process by making sauerkraut and test the effect of changing one variable in the sauerkraut-making process. The Activity involves students for an entire month, the length of the fermentation process. The Activity could tie into home economics (food preparation), history (the use of fermentation to preserve produce), or biology (fermentation, lactic acid cycles, and plant cell morphology) classes.
31	Fizzy Drinks: Stoichiometry You Can Taste. Brian Rohrig. Journal of Chemical Education 2000 77 (12), 1608A.	http://pubs.acs.org/doi/abs/10.1021/ed077p1608A	In this Activity, students make their own version of "Fizzies", a carbonated drink product. Students use different combinations of powdered drink mix, citric acid, baking soda, and water to try to create a good-tasting beverage. The Activity enables students to see the practical benefits of stoichiometry when they use it to develop a product they can immediately consume. It could be used to introduce students to stoichiometry or to conclude a stoichiometry unit.

32 Bubble, Bubble, Toil and Trouble. JCE Staff. Journal of Chemical Education 2001 78 (1), 40A.	http://pubs.acs.org/doi/abs/10.1021/ed078p40A	In this Activity, students first create a standard bubble solution by mixing water with liquid dishwashing detergent. They then add different substances to samples of the detergent solution. The solutions are compared to see which produces the longest-lasting bubbles. The Activity is a fun way to introduce the concepts of surface tension, intermolecular forces, and the use of surfactants. It also fits into a discussion of organic molecules such as soaps and detergents, and the concept of how a molecule can be both hydrophilic and hydrophobic.
33 Sink or Swim: The Cartesian Diver. K. David Pinkerton. Journal of Chemical Education 2001 78 (2), 200A.	http://pubs.acs.org/doi/abs/10.1021/ed078p200A	In this Activity, students assemble a Cartesian diver and observe the effects of changing the pressure and temperature. An optional extension challenges students to cause the diver to hit the bottom in one minute by connecting the diver bottle to a second bottle in which baking soda and vinegar are reacted. The Activity illustrates relationships among pressure, volume, temperature, and buoyancy. It could be used in connection with the concepts of gases and liquids and discussions of Boyle's, Charles's, and the ideal gas laws. The optional extension could be a chemistry recruitment exercise or a year-end project.
34 Burning to Learn: An Introduction to Flame Retardants. JCE Staff. Journal of Chemical Education 2001 78 (3), 328A.	http://pubs.acs.org/doi/abs/10.1021/ed078p328A	In this Activity, students test common household substances to see how they change the way paper burns. Strips of filter paper are soaked in saturated solutions, dried, and briefly held in a flame. The Activity demonstrates the effectiveness of flame retardants. It could be used when discussing combustion reactions or during a unit on practical or everyday chemistry. It could also be used in a safety unit. If boric acid is used, the greenish flame produced may lead to a discussion of electron quantization and atomic emission.

35	Just Breathe: The Oxygen Content of Air. JCE Staff. Journal of Chemical Education 2001 78 (4), 512A.	http://pubs.acs.org/doi/abs/10.1021/ed078p512A	In this Activity, students determine the concentration (percent volume) of oxygen in air. They place small quantities of fine steel wool into a test tube that is then inverted in a beaker of water. Oxygen in the trapped air reacts with the iron to form rust. The Activity ties in well with atmospheric chemistry. Instructors could discuss the rusting reaction as an example of a redox reaction during a unit on electrochemistry. Students also use their knowledge of gas laws and partial pressure to determine the percent volume of oxygen.
36	Putting UV-Sensitive Beads to the Test. Terre Trupp. Journal of Chemical Education 2001 78 (5), 648A.	http://pubs.acs.org/doi/abs/10.1021/ed078p648A	In this Activity, students observe UV-sensitive beads that have been melted into flat disks, explore the temperature behavior of the disks, and then use the disks to investigate the effectiveness of different sunscreens. The Activity shows applications of chemistry in the real world. It could be used as an extension of a kinetics unit or to enhance a discussion of temperature-dependent reactions. The sunscreen testing can enhance consumer science topics similar to those found in the ChemCom curriculum.
37	Putting It All Together: Lab Reports and Legos. JCE Staff. Journal of Chemical Education 2001 78 (9), 1192A.	http://pubs.acs.org/doi/abs/10.1021/ed078p1192A	In this Activity, students study a structure made from Lego blocks and then attempt to build the structure from memory. During a second examination of the structure, students write building instructions. The instructions are then given to another student who attempts to recreate the structure without looking at the original. The Activity illustrates important concepts of laboratory report writing, including the ideas that records and observations should be written down immediately, and that clear and concise writing is necessary when recording information. The Activity could be used to lead off a laboratory component of a course, or as a teaching tool after one or two laboratory reports have been handed in.

38	Pigments of Your Imagination: Making Artist's Paints. Nancy S. Gettys. Journal of Chemical Education 2001 78 (10), 1320A.	http://pubs.acs.org/doi/abs/10.1021/ed078p1320A	In this Activity, students make and examine the characteristics of egg tempera paint. Instructors may also wish to emphasize the chemistry of paint and pigments, the history of the development of different types of paints, or to attempt to duplicate commercial paints as closely as possible. This Activity might be used to integrate chemistry into an art class. An art instructor or artist might speak to a chemistry class or try using the homemade paints. The Activity's online supplement can be used to extend the Activity for several additional periods.
39	New Paper from Newspaper. JCE Staff. Journal of Chemical Education 2001 78 (11), 1512A.	http://pubs.acs.org/doi/abs/10.1021/ed078p1512A	In this Activity, students examine a piece of newsprint and recycle the paper to make a new sheet of paper that can be compared to other types of paper. They then use this experience, and information from Internet sites, to create a paper work of art. The Activity could be used as a cross-curricular topic in an art class. Chemical topics include polymers, since paper is composed of cellulose, and the bonding that occurs within paper.
40	LEDs Are Diodes. Cynthia G. Widstrand, Jonathan Breitzer, Arthur B. Ellis, George C. Lisensky, and S. Michael Condren. Journal of Chemical Education 2001 78 (12), 1664A.	http://pubs.acs.org/doi/abs/10.1021/ed078p1664A	In this Activity, students compare incandescent bulbs and LEDs powered by dc and ac voltage sources. They use circuits made from cut-up holiday light strands, with some of the incandescent bulbs replaced with LEDs. The diode nature of LEDs is demonstrated, as well as the energy associated with different wavelengths of light. The Activity illustrates the structure and properties of matter, the interactions of energy and matter, the relationship of energy and color, and the contributions of chemistry to high-tech materials.

41	Tick Tock, a Vitamin C Clock. Stephen W. Wright. Journal of Chemical Education 2002 79 (1), 40A.	http://pubs.acs.org/doi/abs/10.1021/ed079p40A	In this Activity, students make a chemical clock using chemicals found in the supermarket: vitamin C tablets, tincture of iodine (2%), hydrogen peroxide (3%), and liquid laundry starch. They investigate what happens to the speed of the clock when the reactant solutions are made more or less dilute. This Activity can be used to explore reaction kinetics, and in particular the effect of reactant concentrations on the apparent rate of a reaction. It can also be used in a discussion of redox chemistry, the descriptive chemistry of iodine, and the chemistry of vitamin C.
42	Rubber Bands, Free Energy, and Le Châtelier's Principle. Warren Hirsch. Journal of Chemical Education 2002 79 (2), 200A.	http://pubs.acs.org/doi/abs/10.1021/ed079p200A	In this Activity, students compare the temperature change of a rubber band that is quickly stretched compared to one that is quickly relaxed. They predict what effect the stress of heating will have on a stretched rubber strip and test their prediction. This Activity relates to the concepts of endothermic and exothermic processes, spontaneous and non-spontaneous processes, Le Châtelier's principle, structure-related entropy in polymers, and Gibbs free energy, as well as the interplay of enthalpy and intermolecular forces.
43	Lego Stoichiometry. J. Eric Witzel. Journal of Chemical Education 2002 79 (3), 352A.	http://pubs.acs.org/doi/abs/10.1021/ed079p352A	In this Activity, students use building-block car kits to explore stoichiometry in a concrete manner. They determine the relationship between the number and mass of each required car component (the pieces in the kit) and the mass of the final product (the completed car). This Activity works well as either an introduction or review of stoichiometry. It includes the concepts of limiting and excess reagents, and reinforces understanding of the law of conservation of matter.

44	An After-Dinner Trick. JCE Staff. Journal of Chemical Education 2002 79 (4), 480A.	http://pubs.acs.org/doi/abs/10.1021/ed079p480A	In this Activity, students investigate a classic chemistry demonstration that uses the phenomenon of freezing-point depression to lift an ice cube out of a glass of water with a thread. They first test how adding salt, pepper, cream, and sugar to cold water affects the temperature. They then use the information gathered to design a procedure to lift the ice cube using any of the four substances. Use of this Activity could accompany discussion on changes of states, especially freezing and melting. It could also be used during a unit on solutions chemistry and colligative properties. The Activity could be extended to a quantitative us of the freezing-point depression equation.
45	Meltdown Showdown! Which Deicer Works Best? John W. Lyga. Journal of Chemical Education 2002 79 (5), 592A.	http://pubs.acs.org/doi/abs/10.1021/ed079p592A	In this Activity, students test two chemical deicers, rock salt (sodium chloride) and calcium chloride, to determine which melts ice better and whether it is worth the extra cost to buy a more expensive deicer. They perform three tests comparing the two deicers, predict which will be more effective at melting through a thin disk of ice, and then test their prediction. An extension to this Activity is to integrate it into a discussion about ecology. Although sodium chloride and calcium chloride are the most common deicers, they are not the most environmentally friendly.
46	Measurements for a Rainy Day. Erica K. Jacobsen and Nancy S. Gettys. Journal of Chemical Education 2002 79 (9), 1104A.	http://pubs.acs.org/doi/abs/10.1021/ed079p1104A	In this Activity, students collect data outdoors on a rainy day using plates and paper towels and use the information to calculate the rate of rainfall. This Activity reinforces ideas about density, mass, volume, area, length, and units. The terms precision and accuracy could be introduced and discussed, as well as the problem of selecting appropriate samples for measurements that are representative of a large quantity of material or a complex phenomenon. The use of significant digits in measurements and calculations can be emphasized. Students also practice the skills of making observations and taking careful, quantitative measurements.

47	Brushing Up on Chemistry. Ashley Trantow. Journal of Chemical Education 2002 79 (10), 1168A.	http://pubs.acs.org/doi/abs/10.1021/ed079p1168A	In this Activity, students make their own toothpaste and use various tests to compare its properties with those of commercial toothpaste. This includes testing its ability to remove stains from the dyed shells of hard-boiled eggs. The Activity allows students to discover more about a cleaning product they use every day. Areas for discussion include the differences between an eggshell and tooth enamel, the use of cleaning or whitening agents, and the facts that a homemade toothpaste costs less, does not contain fluoride, and is more abrasive (which might damage tooth enamel).
48	Through the Looking Glass. JCE Staff. Journal of Chemical Education 2002 79 (11), 1360A.	http://pubs.acs.org/doi/abs/10.1021/ed079p1360A	In this Activity, students compare several different window cleaner recipes to determine the purpose each ingredient in a window cleaner serves. They use different combinations of water (solvent), isopropyl alcohol (wetting agent), and ammonia (grease cutter). They then develop their own "New and Improved" recipe to test its performance against commercial window cleaner. The Activity ties in with consumer chemistry. Instructors could also discuss the hydrolysis reaction between ammonia and a fat that allows ammonia to work well as a grease cutter. Interdisciplinary extensions for art, business, and language arts classes could be to develop a marketing campaign for a window cleaner, including written advertisements, videotaped commercials, and container designs.

49	Acid-Base Reactions with Carbon Dioxide. Ana Paula Carvalho, Ângela F. S. S. Mendonça, and M. Fátima M. Piedade. Journal of Chemical Education 2002 79 (12), 1464A.	http://pubs.acs.org/doi/abs/10.1021/ed079p1464A	In this Activity, students investigate two acid-base reactions. In the first reaction, an aqueous solution of powdered laundry detergent is neutralized with the acid formed by the dissolution of exhaled carbon dioxide. This uses the spice turmeric as an indicator. In the second reaction, vinegar and baking soda produce carbon dioxide gas. Powdered laundry detergent is added to the reaction mixture to obtain a longer-lasting, thick foam. Questions for the students connect the two reactions in terms of how carbon dioxide plays a role in both reactions. This Activity can be used when acid-base reactions are introduced in the curriculum or when carbon dioxide is discussed. The reactions could also be used as demonstrations or guided hands-on activities for younger children
50	Acid Raindrops Keep Fallin' in My Lake. JCE Staff. Journal of Chemical Education 2003 80 (1), 40A.	http://pubs.acs.org/doi/abs/10.1021/ed080p40A	In this Activity, students simulate acid rain falling on lakes by adding vinegar to bowls of water. Several of the bowls contain solids such as crushed, low-dust chalk, sand, and lime. Students determine whether the solids affect the acidity of each solution over two days by periodically removing samples of each solution for testing with red cabbage indicator. This Activity is an easy simulation that could be performed at home in conjunction with a classroom discussion on acid rain. It includes the ideas of acidity, indicators, and neutralization reactions. Students could research the acidity of local rain and its effects on nearby lakes and water supplies.
51	Mass Spectra. JCE Staff. Journal of Chemical Education 2003 80 (2), 176A.	http://pubs.acs.org/doi/abs/10.1021/ed080p176A	In this Activity, students solve puzzles that are analogous to finding the amino acid sequence of a peptide using mass spectrometry. Students identify words that have been broken into letters or groups of letters. In many textbooks instrumental analysis and various types of spectrometry are mentioned only in passing. This Activity provides a way to cover a complex topic more completely and could also be offered as an enrichment activity for students, or as an exercise in analytical thinking.

52	Flipping Pennies and Burning Candles: Adventures in Kinetics. Michael J. Sanger. Journal of Chemical Education 2003 80 (3), 304A.	http://pubs.acs.org/doi/abs/10.1021/ed080p304A	In this Activity, students collect data to determine whether two processes, flipping pennies and burning small birthday candles, follow zeroth- or first-order rate laws. Students first collect data on the number of pennies remaining "heads up" after several successive tosses and then measure the mass of a burning candle over time. This Activity is inquiry-based and introduces reaction orders, determining reaction orders, and calculating simple kinetics. Instructors may wish to have students perform kinetics experiments involving chemical reactions after completing this Activity.
53	Apple Fool! An Introduction to Artificial Flavors. JCE Staff. Journal of Chemical Education 2003 80 (4), 408A.	http://pubs.acs.org/doi/abs/10.1021/ed080p408A	In this Activity, students investigate flavorings by making artificial "cooked apples" from a mixture of crackers, sugar, cream of tartar, and water, as is done for the filling in recipes for Mock Apple Pie. This Activity focuses on consumer chemistry, and can be used to introduce natural and artificial flavors or lab experiments that make esters. It may also be extended to include taste testing and pie baking and has connections with home economics and history.
54	Out of the Blue. Mark E. Noble. Journal of Chemical Education 2003 80 (5), 536A.	http://pubs.acs.org/doi/abs/10.1021/ed080p536A	In this Activity, students first prepare a standard formulation for a variation on the classic blue bottle reaction using consumer chemicals. They then make appropriate changes to the formulation and observe the results to determine the roles played by each reactant. This Activity could be used with units on chemical kinetics and oxidation-reduction reactions.
55	Diffusion of Water through a Differentially Permeable Membrane. Maria Guadalupe Bertoluzzo, Fabio E. Quattrin, Stella Maris Bertoluzzo, and Ruben Rigatuso. Journal of Chemical Education 2003 80 (9), 1032A.	http://pubs.acs.org/doi/abs/10.1021/ed080p1032A	In this Activity, students investigate the process of osmosis through a differentially-permeable membrane formed by the precipitation of copper(II) hexacyanoferrate(II). This Activity allows students to watch and investigate osmosis, which reinforces the concept of transport in living cells. Instructors could contrast osmosis with diffusion, a principal method of movement of substances within biological cells. A referenced demonstration model of osmosis could be used to visually introduce the Activity.

56	Where There's Fire There's.... Stephen W. Wright. Journal of Chemical Education 2003 80 (10), 1160A.	http://pubs.acs.org/doi/abs/10.1021/ed080p1160A	In this Activity, students compare the combustion of different substances such as a glowing wooden toothpick and lit birthday candle in air, oxygen, exhaled breath, and carbon dioxide environments. The oxygen and carbon dioxide are generated from supermarket chemicals. This Activity can be used to explore the chemistry of oxygen and combustion. It can also be used in a discussion of redox chemistry or of reaction kinetics, and in particular the effect of a reactant concentration on the apparent rate of a reaction (combustion).
57	Pondering Packing Peanut Polymers. Perry A. Cook, Sue Hall, and Jill Donahue. Journal of Chemical Education 2003 80 (11), 1288A.	http://pubs.acs.org/doi/abs/10.1021/ed080p1288A	In this Activity, students compare polystyrene and cornstarch packing materials ("peanuts"). Both are made of polymers, but because of their composition, they behave very differently in various solvents. Students extrapolate how these differences in behavior relate to environmental effects, such as filling landfills with non-biodegradable materials. This Activity illustrates applications of chemistry in the real world. It integrates with units on environmental impact, states of matter, physical and chemical changes, or science process skills. It also correlates with the study of industrial processes in manufacturing.
58	Bath Bubblers. Barbara Walker and Mary E. Harris. Journal of Chemical Education 2003 80 (12), 1416A.	http://pubs.acs.org/doi/abs/10.1021/ed080p1416A	In this Activity, students use citric acid and baking soda to make "bath bubblers" similar to those sold in bath and body stores. They investigate the fizzing reaction that occurs when the bubblers are added to both cold and hot water. Bringing this real world product into the classroom adds interest and can lead to creativity, while introducing both acid/base concepts and rates of reaction. Further experiments can be performed using Alka-Seltzer tablets, which also contain citric acid and baking soda, and produce carbon dioxide when in contact with water.

59	Some Like It Hot, Some Like It Cold. Robert G. Silberman. Journal of Chemical Education 2004 81 (1), 64A.	http://pubs.acs.org/doi/abs/10.1021/ed081p64A	In this Activity, students combine liquids in a calorimeter and use a thermometer to determine if the reaction mixture gets hot or cold. All of the chemicals (yeast, hydrogen peroxide, vinegar and baking soda) except ammonium nitrate, are available in supermarkets. The goal is to find a combination of a liquid and a solid that could serve as the basis for a cold pack of the type used for athletic injuries. This Activity focuses on heats of reaction and heats of solution. It can be used as an introduction to thermodynamics and calorimeters. It can also be extended to use quantitative data of heats of reactions, heats of solutions, and Hess's law.
60	Water Filtration. Erica K. Jacobsen. Journal of Chemical Education 2004 81 (2), 224A.	http://pubs.acs.org/doi/abs/10.1021/ed081p224A	In this Activity, students make a water filtration column using a 2-liter plastic beverage bottle that contains layers of gravel, sand, and activated charcoal. They prepare a contaminated sample of water and examine the filtration ability of the column. This environmental chemistry Activity can be used to complement a celebration of Earth Day. It can be used in a discussion of water quality, pollution, and the treatments water undergoes before it reaches the faucet. It can also be extended to include discussions about commercially available water filters, such as Brita.
61	Checkerboard Chromatography. Charles A. Smith. Journal of Chemical Education 2004 81 (3), 384A.	http://pubs.acs.org/doi/abs/10.1021/ed081p384A	In this Activity, column chromatography separations are simulated using a grid, colored paper squares, and a six-sided die. Students observe the effects of changing flow rate, column length, and mobile phase composition. As squares come off the grid, the separation (or lack thereof) of the colors is noticeable. This board-game style procedure offers insights into column chromatography and how separations are achieved. The Activity is best performed after the class has discussed solubility and polarity. Terminology including resolution, dead time, isocratic, gradient, and diffusion can be introduced.

62	Color My Nanoworld. Adam D. McFarland, Christy L. Haynes, Chad A. Mirkin, Richard P. Van Duyne, and Hilary A. Godwin. Journal of Chemical Education 2004 81 (4), 544A.	http://pubs.acs.org/doi/abs/10.1021/ed081p544A	This Activity introduces students to the unique properties of nanoscale materials through exploration of size-dependent optical properties of gold nanoparticles. Students first prepare a solution of gold nanoparticles. They then investigate the solution's use as an electrolyte sensor by adding a non-electrolyte and a strong electrolyte, and observing any resulting color changes. This Activity provides an introduction to scientific notation and orders of magnitude by exposing students to nano-sized materials. The Activity also provides connections to topics such as electrolytes, complementary colors, and spectroscopy.
63	Determining Rate of Flow through a Funnel. Martin Bartholow. Journal of Chemical Education 2004 81 (5), 672A.	http://pubs.acs.org/doi/abs/10.1021/ed081p672A	In this Activity, students make funnels using plastic beverage bottles and rubber stoppers with differing numbers of holes or sizes of holes. They then determine the rate of flow of water through the funnels and identify factors that affect the rate of flow. This Activity uses easy-to-observe phenomena that model a chemical reaction with an identifiable rate-controlling step. This Activity can be extended to include other experiments that model kinetics as well as to introduce graphs in kinetics before students study an actual chemical reaction.
64	Bowling for Density! Kathleen Holley, Diana Mason, and Kirk Hunter. Journal of Chemical Education 2004 81 (9), 1312A.	http://pubs.acs.org/doi/abs/10.1021/ed081p1312A	In this Activity, students predict whether a given bowling ball will float or sink in tap water. Students design a procedure to collect radius and weight measurements to calculate the density of their ball. They then test their prediction by placing the ball in a large container of water, which yields the surprising observation that some bowling balls do float. Students gain practice in measurement techniques as well as calculations involving unit conversions and geometric formulae. This Activity could be used in curriculum units dealing with measurement, unit conversions, significant figures, or physical properties of matter such as density.

65	Calories—Who's Counting? JCE Staff. Journal of Chemical Education 2004 81 (10), 1440A.	http://pubs.acs.org/doi/abs/10.1021/ed081p1440A	In this Activity, students determine how many calories are released per gram when marshmallows and cashews burn and then compare the quantity of energy available from carbohydrates versus fats. Students burn the food items beneath a metal soft drink can containing water and measure the resulting change in temperature of the water. This Activity can be used to introduce calorimetry, or as an investigation of types of food molecules.
66	A Magnetic Meal. JCE Staff. Journal of Chemical Education 2004 81 (11), 1584A.	http://pubs.acs.org/doi/abs/10.1021/ed081p1584A	In this Activity, students make slurries of breakfast cereal and water and use a magnetic wand to collect elemental iron filings that are present in some cereals. They determine the mass of iron collected and then calculate the "recommended daily allowance" (RDA) in each cereal. An extension uses qualitative tests to confirm that the material collected is actually iron. This Activity connects chemistry to an item that students probably see (and eat!) often. Many students will find it surprising that metallic fillings are present in a food item. The Activity can lead to a discussion of why iron is/is not used in food items in this form. Instructors can also discuss biochemical issues such as what happens to iron in the body, why iron is a crucial nutrient, and the definition of RDA.
67	Flame Tests: Which Ion Causes the Color? Michael J. Sanger. Journal of Chemical Education 2004 81 (12), 1776A.	http://pubs.acs.org/doi/abs/10.1021/ed081p1776A	In this Activity, students perform simple flame tests using eleven commercially available compounds, cotton swabs, and a Bunsen burner. They then determine whether the cations or anions in each compound are responsible for the flame test colors. This Activity introduces students to flame tests in an inquiry-based manner. Most laboratory manuals state that the metal cation in an ionic compound is usually responsible for flame test colors and students verify this fact. This activity also illustrates the importance of controlling variables and making meaningful comparisons.

68	Turning on the Light. Patricia B. O'Hara, Wayne St. Peter, and Carol Engelson. Journal of Chemical Education 2005 82 (1), 48A.	http://pubs.acs.org/doi/abs/10.1021/ed082p48A	In this Activity, students investigate the luminescent properties of common items such as glow-in-the-dark stickers, wintergreen-flavored hard candies, and a chlorophyll solution made from spinach leaves. After making observations, they use a flowchart to categorize the luminescent items as fluorescent, phosphorescent, or triboluminescent. This Activity allows students to directly see emission of light as a result of electron transitions. It could be used as an introduction to atomic structure. It also illustrates the concepts of energy transformation and conservation; it could be useful during a discussion of photosynthesis in an AP Biology class.
69	A Cool Drink: An Introduction to Concentrations. Mindy Bedrossian. Journal of Chemical Education 2005 82 (2), 240A.	http://pubs.acs.org/doi/abs/10.1021/ed082p240A	In this Activity, students investigate concentration levels by using serial dilution to prepare several solutions of presweetened powdered drink mix. Students taste the solutions to determine at which concentration they first discern the sweetness. A connection is also made to the concentration of pollutants in air. This Activity can be used as a precursor to discussing concentration and dilution, and the idea of parts per million, and correlates well with discussions on air and water pollution.
70	The Nature of Hydrogen Bonding. Emeric Schultz. Journal of Chemical Education 2005 82 (3), 400A.	http://pubs.acs.org/doi/abs/10.1021/ed082p400A	In this Activity, students build models of polarized water molecules using K'nex toy components and adhesive Velcro. Students investigate hydrogen bonding by shaking the models in various ways. They observe the resulting interactions and relate their observations to physical states of water and the difference between strong bonds and weak attractions. This Activity complements curricular coverage on changes of state such as the melting and boiling of water. The Activity could introduce the importance of intermolecular forces in determining the states of matter. It could also be used after units on electronegativity and bond and molecular polarity.

71	Investigating the Invisible: Attenuation of Radio Waves. Anthony A. Smith and Charles A. Smith. Journal of Chemical Education 2005 82 (4), 560A.	http://pubs.acs.org/doi/abs/10.1021/ed082p560A	In this Activity, students investigate properties of radiation using a handheld radio. Students compare the abilities of conductive and dielectric materials to attenuate or block, radio waves, and compare the attenuation of AM versus FM radio waves. The radio is placed inside different objects and students record which materials blocked or attenuated the waves. It is often difficult for students to visualize the electric and magnetic fields that compose light and that different frequencies of light have different wavelengths. This Activity helps students to explore these concepts in a novel fashion, and leads them to interactively investigate properties of something that can't be seen (radiation).
72	Nanopatterning with Lithography. Christy L. Haynes, Adam D. McFarland, Richard P. Van Duyne, and Hilary A. Godwin. Journal of Chemical Education 2005 82 (5), 768A.	http://pubs.acs.org/doi/abs/10.1021/ed082p768A	In this Activity, students learn the general principles of serial and parallel nanofabrication techniques. Students use nylon spheres, contact paper, and talcum powder to form patterns. Using this macroscale analogy, students explore the parallel fabrication technique known as nanosphere lithography. This Activity can be integrated into discussions on the transition from individual atoms to extended structures. Instructors can draw parallels to atom packing in solids as well as emphasize geometry concepts. This Activity can be extended to include photolithography by using a UV lamp and photosensitive paper to develop the patterns.
73	Colors in Liquid Crystals. George Lisensky and Elizabeth Boatman. Journal of Chemical Education 2005 82 (9), 1360A.	http://pubs.acs.org/doi/abs/10.1021/ed082p1360A	In this Activity, students investigate the relationship between temperature and composition and the reflected and transmitted colors of a common nanoscale material, the cholesteric liquid crystal. This Activity is suitable for exploring relationships between color, wavelength, reflection, and transmission and illustrates how temperature changes the Bragg reflection wavelength in liquid crystals. This Activity can also be used to explore the relationship between melting point and crystal packing.

74 Memory Metal. JCE Staff. Journal of Chemical Education 2005 82 (10), 1488A.	http://pubs.acs.org/doi/abs/10.1021/ed082p1488A	In this Activity, students compare the properties of nitinol metal wire (known as "memory" metal) and ordinary wire. Using the observed properties, they design (and possibly make) a toy that would use memory metal to operate. This Activity connects toys with science, and allows students to become inventors as they design a toy of their own. This Activity ties in well with a discussion of the properties and structure of metals and alloys, and is an example of a solid-to-solid phase change.
75 Trusty or Rusty? Oxidation Rate of Nails. Stephen W. Wright. Journal of Chemical Education 2005 82 (11), 1648A.	http://pubs.acs.org/doi/abs/10.1021/ed082p1648A	In this Activity, students investigate the process of rusting by studying the oxidation of steel nails in a gel using supermarket chemicals. An indicator makes the presence of Fe^{3+} produced by the oxidation visible. Factors that accelerate or retard the rate of iron oxidation are studied. This Activity can be used to understand redox chemistry and the relative oxidation potentials of various metals. It illustrates one of the most common reactions of iron and approaches used to retard that reaction.
76 I Screen, You Screen, We All Screen for Phenolics. Michael B. Sady. Journal of Chemical Education 2005 82 (12), 1808A.	http://pubs.acs.org/doi/abs/10.1021/ed082p1808A	In this Activity, students use a colorimetric visualization test to screen grape juice for phenolic content. Students use the test to examine differences in phenolic content of juices prepared with different processing methods. Most of the materials are readily available at the supermarket. The Activity could be adapted for use with other fruit juices and might be included in a biology or nutrition class. This Activity could be further extended with a trip to a farm or vineyard for analysis of ripe grapes.

77 Modeling Dynamic Equilibrium with Coins. Martin Bartholow. Journal of Chemical Education 2006 83 (1), 48A.	http://pubs.acs.org/doi/abs/10.1021/ed083p48A	This Activity explores factors that influence dynamic equilibrium, including how long it takes two populations to equilibrate, and the relative amounts of reactants and products present at equilibrium. Students first use concrete objects (coins), then progress to mathematical calculations of equilibrium without physically manipulating the objects. The physical movement of objects, followed by numerical analysis, allows students to simulate reaction populations macroscopically. This Activity can be used as an initial introduction to dynamic equilibrium. It can be used as a concrete example when discussing forward-reverse reaction rates and K_{eq} calculations, and tie in to Le Châtelier's principle.
78 Soil Testing: Dig In! Linda N. Fanis and Erica K. Jacobsen. Journal of Chemical Education 2006 83 (2), 240A.	http://pubs.acs.org/doi/abs/10.1021/ed083p240A	In this Activity, students collect soil samples and characterize them by examining their physical appearance, water holding capacity, sedimentation, and pH. Based on their observations, they can see that different samples of something as universal as soil can be quite different from each other. This environmental chemistry Activity can be used to complement a celebration of Earth Day. The Activity provides practice in making detailed observations about a real world substance students probably think little about, and ties in well with environmental chemistry concepts and discussions of how soil type impacts the plants it sustains.
79 Popcorn—What's in the Bag? Marissa B. Sherman and Thomas A. Evans. Journal of Chemical Education 2006 83 (3), 416A.	http://pubs.acs.org/doi/abs/10.1021/ed083p416A	In this Activity, students investigate microwave popcorn, the process of microwave-promoted popping, and the materials involved: water, vegetable oils, starch, and special packaging materials. This Activity supports discussion of thermal and electromagnetic energy, phase changes, intermolecular forces, patterns of solubility, and the structure of fats, oils and starches. Nutritional issues related to the biomolecules can also be addressed.

80	Ions or Molecules? Polymer Gels Can Tell. Brett Criswell. Journal of Chemical Education 2006 83 (4), 576A.	http://pubs.acs.org/doi/abs/10.1021/ed083p576A	In this Activity, students first prepare a gel using the superabsorbent polymer sodium polyacrylate (found in certain diapers) and water. The gel is split into piles and samples of different compounds are sprinkled on the piles. Students determine that ionic compounds break down the gel, while covalent compounds have no effect on the gel. This Activity strengthens understanding of the differences between ionic and covalent compounds. It could be coupled with an investigation of the effect of these two classes of compounds on electrical conductivity when added to water. The Activity also ties in well with a discussion of how science is used in the design of consumer products.
81	pHantastic Fluorescence. Mark Muyskens. Journal of Chemical Education 2006 83 (5), 768A.	http://pubs.acs.org/doi/abs/10.1021/ed083p768A	In this Activity, students extract a fluorescent substance from shavings of narra wood. The pH-dependent fluorescence can be turned on and off using household acid and base solutions. A yellow filter blocks the exciting light but not the fluorescent emission. This Activity gets students thinking about the interaction of light and molecules. The Activity demonstrates fluorescence of a natural material, the effects of pH, and the relationship between the color of light and color of solutions.
82	Millikan: Good to the Last (Oil) Drop. Earl F. Pearson. Journal of Chemical Education 2006 83 (9), 1312A.	http://pubs.acs.org/doi/abs/10.1021/ed083p1312A	In this Activity, students simulate Millikan's oil drop experiment using drop-shaped magnets and steel BBs. Students determine the mass of a single BB analogous to the way Millikan determined the charge of a single electron. This is a good Activity to use after a discussion of the concept of atoms, including identification of electrons, protons, and neutrons, and how atoms of one element are different from the atoms of another. This is often done early in the course with a discussion of Dalton's atomic theory.

83 Chemistry of Cement. Patricia Mason. Journal of Chemical Education 2006 83 (10), 1472A.	http://pubs.acs.org/doi/abs/10.1021/ed083p1472A	In this Activity, students use a commercial cement mix to produce concrete. They investigate how changing key variables such as concentrations, curing temperatures, and the addition of various substances affects properties such as setting time, hardness, and plasticity. This Activity introduces students to mixtures and solutions as well as to experimental design in the context of a familiar consumer product.
84 Whatever Floats (or Sinks) Your Can. Michael J. Sanger. Journal of Chemical Education 2006 83 (11), 1632A.	http://pubs.acs.org/doi/abs/10.1021/ed083p1632A	In this Activity, students test whether cans of carbonated beverages sink or float in water and then determine whether caffeine content, soda color, or sugar content in the carbonated sodas is responsible for the buoyancy of the sealed cans. This Activity can be used as an introduction to density in a middle school physical science course, or a high school chemistry or physics course. It can also be used in elementary or middle school courses as an experiment in controlling variables and making meaningful comparisons.
85 A Kool Reaction from the Fine Print. Susan A. S. Hershberger and Arlyne M. Sarquis. Journal of Chemical Education 2006 83 (12), 1792A.	http://pubs.acs.org/doi/abs/10.1021/ed083p1792A	In this Activity, students gain an understanding of the importance of reading reagent labels both in chemistry class and on consumer products. Students explore the chemistry behind the directive on a package of Kool-Aid "Do not store in a metal container". The Activity illustrates properties of acids and metals. This Activity complements safety discussions, especially the importance of reading labels, and fits with an introduction to the properties of strong and weak acids (tastes sour, turns litmus paper red, and reacts with a metal). In addition, the Activity illustrates metals as reducing agents and qualitatively illustrates kinetics.

86 Cooking Up Colors from Plants, Fabric, and Metal. Jennifer E. Mihalick and Kathleen M. Donnelly. Journal of Chemical Education 2007 84 (1), 96A.	http://pubs.acs.org/doi/abs/10.1021/ed084p96A	In this Activity, students dye fabric squares with two plant dyes: aqueous extracts of tea leaves and of marigold flowers. They investigate how the addition of iron to a dye bath affects the resulting color and fastness of the dyed fabrics and observe that the type of fabric affects the results. This Activity can accompany a discussion of the impressive array of chemicals produced by plants. Students can learn that the different appearances and textures of fibers are due to differences in chemical structures. The importance of intermolecular forces in the dyeing process can be demonstrated.
87 Garbage Juice: Waste Management and Leachate Generation. Jenna R. Jambeck and Jean M. Andino. Journal of Chemical Education 2007 84 (2), 240A.	http://pubs.acs.org/doi/abs/10.1021/ed084p240A	In this Activity, students use multi-colored breakfast cereal and liquid to model the concepts of leachate and leaching from municipal solid waste disposed of in a landfill. Students create a modern landfill model with the same material. This environmental chemistry Activity can be used to complement a celebration of Earth Day. This Activity can easily be integrated into a discussion of waste composition and quantity. After this Activity, students may re-evaluate how much trash they throw away and how they dispose of it. This Activity could be extended to include a field trip to a hazardous household waste collection center or landfill.
88 Cool! Rates of Heating and Cooling. Martin Bartholow. Journal of Chemical Education 2007 84 (3), 448A.	http://pubs.acs.org/doi/abs/10.1021/ed084p448A	In this Activity, students measure the rate of warming for a chilled thermometer bulb held in room temperature air, for a chilled bulb held between two fingers, and for a few milliliters of ice-cold water. Students discover that the warming process is not linear. This Activity emphasizes the importance of measuring temperature change and its relevance to other experiments. Rates of warming and cooling can lead into a kinetic description of heat and matter.

89 Colorful Lather Printing. Susan A. S. Hershberger, Matt Nance, Arlyne M. Sarquis, and Lynn M. Hogue. Journal of Chemical Education 2007 84 (4), 608A	http://pubs.acs.org/doi/abs/10.1021/ed084p608A	In this Activity, students marble paper with shaving cream and food color while exploring water, polarity, and hydrophilic and hydrophobic materials. Although the Activity is familiar, it contains a new twist—exploring how a colored shaving cream mixture behaves when a drop of water is added. This Activity can be used to introduce the concepts of polarity, soaps, and surfactants. The composition of shaving cream lends itself to a discussion of types of phases, mixtures, and in particular, a discussion of foams as colloids. The careers of consumer product chemists and the chemistry of other consumer products may also be relevant. Paper marbling is an ancient art, so the Activity can be integrated with art or history lessons.
90 How Does Your Laundry Glow? Richard B. Weinberg. Journal of Chemical Education 2007 84 (5), 800A	http://pubs.acs.org/doi/abs/10.1021/ed084p800A	In this Activity, students examine the effect of pH on the intensity and color of the emission of fluorescent dyes in liquid laundry detergent. They perform two titrations using vinegar to estimate the pH at which the fluorescence properties change. In the second titration, sodium bicarbonate is added to buffer the detergent solution. This Activity illustrates the principles of UV-excited fluorescence, pH indicators, and the effect of buffers. It can also be used as a starting point for discussions of the environmental impact of consumer chemicals present in wastewater.
91 Fluorescent Fun: Using a Homemade Fluorometer. M. Farooq Wahab. Journal of Chemical Education 2007 84 (8), 1312A	http://pubs.acs.org/doi/abs/10.1021/ed084p1312A	In this Activity, students investigate the fluorescence of highlighter marker ink and the principles employed in studying fluorescent molecules using a homemade fluorometer and different colored filters. This Activity helps students understand how certain molecules interact with light, and that fluorescence is one of the ways these molecules can lose their excess energy after they absorb light energy.

92 Testing for Iodide in Table Salt. Stephen W. Wright. Journal of Chemical Education 2007 84 (10), 1616A	http://pubs.acs.org/doi/abs/10.1021/ed084p1616A	In this Activity, students use supermarket chemicals to test samples of table salt for the presence of iodine, an essential micronutrient added as iodide ion. The presence of iodide in the salt is made apparent by the appearance of a blue color. This Activity can introduce the subject of micronutrients, in terms of their importance and how they may be supplied to a population to prevent disease. It can also be used in a discussion of redox chemistry or the descriptive chemistry of iodine, particularly the facile oxidation of iodide to iodine and the formation of the blue starch-iodine complex.
93 Aluminum—Air Battery. Modesto Tamez and Julie H. Yu. Journal of Chemical Education 2007 84 (12), 1936A	http://pubs.acs.org/doi/abs/10.1021/ed084p1936A	In this Activity, students construct a simple battery from aluminum foil, saltwater, and activated charcoal. The battery can power a small motor or light. This Activity demonstrates oxidation and reduction reactions, which are integral parts of battery chemistry. The use of atmospheric oxygen as an oxidizing agent has extensions to other redox reactions that occur in corrosion, metabolism, and combustion. In addition, the participation of oxygen as a reactant in the aluminum-air battery can be used to introduce the concepts of fuel cells and alternative energy sources.
94 Hold the Heat: Global Heat Retention, Global Warming and Calorimetry. Harold S. Johnston and Joel D. Burley. Journal of Chemical Education 2008 85 (2), 224A	http://pubs.acs.org/doi/abs/10.1021/ed085p224A	In this Activity, students perform quantitative calorimetric measurements on samples of ice/water heated by incandescent light bulbs and/or convection with room-temperature surroundings. They measure and graph temperature as a function of time. They observe that the temperature of the ice water samples remains constant for a time as the ice melts, and that the addition of heat energy to a substance does not necessarily cause its temperature to increase. This is linked with the topic of global warming, and can be extended to include a broader discussion of this topic. This Activity can also be a stand-alone introduction to calorimetry.

95	A Candle in the Wind. Robert J. Eierman. Journal of Chemical Education 2008 85 (4), 528A	http://pubs.acs.org/doi/abs/10.1021/ed085p528A	In this Activity, students investigate physical changes that occur in a candle to learn how a candle functions and how you can blow it out. This Activity is based on a series of lectures presented by Michael Faraday in the 1850s. Candles can help to illustrate numerous chemical principles, including phases of matter, processes of melting and vaporization, gas-phase oxidation/reduction chemistry, complete and incomplete combustion, several modes of transport (capillary action, diffusion, buoyancy), activation energy (a match), and multiple thermodynamic principles.
96	Fun with Fingerprints: Cyanoacrylate Fuming. Karaliota A. Lymperopoulou and Anastasios Nikitakis. Journal of Chemical Education 2008 85 (6), 816A	http://pubs.acs.org/doi/abs/10.1021/ed085p816A	In this Activity, students develop fingerprints using the cyanoacrylate fuming method on different types of surfaces. They investigate the technique's effectiveness and test the effects of changing the temperature and humidity of the fuming chamber. This Activity can enhance teaching of chemical concepts such as: states of matter, evaporation, solubility of organic compounds, chemical reactions including polymerization, and gas adsorption in thin liquid layers. It can also serve as an interdisciplinary activity with connections to biology (skin form and function) and biochemistry (biomolecules in sweat secretions).
97	The Sweeter Side of Density. Michael Davis and Charles Henry. Journal of Chemical Education 2008 85 (8), 1088A	http://pubs.acs.org/doi/abs/10.1021/ed085p1088A	In this Activity, students determine the density of different sugar solutions (0-50%). They then dye the solutions and devise a method to combine the solutions to make a multi-colored, layered heterogeneous mixture. This Activity could be used in units dealing with measurement or density. The Activity also underscores the idea that less dense objects float relative to their more dense surroundings. As an extension, students could use standard sugar solutions to determine the sugar content of a commercial beverage.

98	That's the Way the Ball Bounces (or Is It?). Erica K. Jacobsen. Journal of Chemical Education 2008 85 (10), 1376A	http://pubs.acs.org/doi/abs/10.1021/ed085p1376A	In this Activity, students investigate the physical properties of different balls that may look similar, but have very different rebound properties. Students also investigate how the rebound properties change when the balls are subjected to near freezing and near boiling temperatures. This Activity could be used at the beginning of the school year as an exercise in making observations. It could relate to units on physical properties and polymers.
99	Clip Clues: Discovering Chemical Formulas. Carmen Fies and Diana Mason. Journal of Chemical Education 2008 85 (12), 1648A	http://pubs.acs.org/doi/abs/10.1021/ed085p1648A	In this Activity, students use their deductive reasoning skills as they identify formulas of unknown elements and compounds modeled by paperclips. Each color of paperclip represents a different element, with linkages between different paperclips in appropriate ratios representing 20 unknowns. The Activity supports formation of a basic understanding of elements and compounds, including allotropes, oxidation states, and diatomic elements. This Activity supports curriculum units dealing with physical and chemical properties of matter, nomenclature, and how various metal-nonmetal compounds form.
100	How Heavy Is a Balloon? Using the Ideal Gas Law. Bettie Obi Johnson and Henry Van Milligan. Journal of Chemical Education 2009 86 (2), 224A	http://pubs.acs.org/doi/abs/10.1021/ed086p224A	In this Activity, students explore buoyancy with helium-filled Mylar balloons. They use the ideal gas law to predict the mass of the balloon if it were empty, compare it to the actual mass of the empty balloon, and discuss experimental sources of error. This Activity demonstrates the ideal gas law and introduces students to the concept of buoyancy.
101	The Secret of Smart Paper. Brian McCall, Lynn Diener, and J. Aura Gimm. Journal of Chemical Education 2009 86 (4), 464A	http://pubs.acs.org/doi/abs/10.1021/ed086p464A	This Activity introduces students to a technology called microencapsulation. In the activity, students learn about special papers that use microencapsulation—such as grocery store receipts, carbonless lab notebooks, and some questionnaires—that they encounter everyday. In this activity students perform a hands-on exploration of three-part carbonless copy paper, learning about the paper through their own personal observations.

102	Investigating Self-Assembly with Macaroni. David A. Burgan and Lane A. Baker. Journal of Chemical Education 2009 86 (6), 704A	http://pubs.acs.org/doi/abs/10.1021/ed086p704A	In this Activity students learn the concept of self-assembly, a powerful tool for creating ordered structures in chemistry and biology. A macroscale example—self-organized macaroni noodles—is described in analogy to the self-assembly of lipid molecules that make up the membranes of cells, or to self-assembled materials, such as self-assembled monolayers. This activity can be incorporated in discussions of noncovalent interactions in general chemistry or in discussions of cell membrane structure in biochemistry. The final product of this activity is a nonhazardous macroscale example of self-assembly that students can poke, prod, and investigate.
103	Enjoy a Hot Drink, Thanks to Chemistry! Gabriel Pinto, Maria T. Oliver-Hoyo, and Juan Antonio Llorens-Molina. Journal of Chemical Education 2009 86 (11), 1280A	http://pubs.acs.org/doi/abs/10.1021/ed086p1280A	In this Activity students investigate the heat produced by the dissolution process of calcium chloride in water and use that information to discuss how self-heating containers work to warm food and drink products.
104	A Novel, Simplified Scheme for Plastics Identification. Mary E. Harris and Barbara Walker. Journal of Chemical Education 2010 87 (2), 147-149	http://pubs.acs.org/doi/abs/10.1021/ed800055p	In this Activity, students identify samples of seven types of recyclable plastic by using a flowchart scheme. The flowchart procedure includes making density comparisons of the plastic samples in water and alcohol and observing physical changes of plastic samples subjected to boiling water temperatures and exposure to acetone. This scheme is modified from previous published papers to make it accessible to middle schools, where laboratory facilities are likely to be less extensive, as well as to high schools or colleges. Including corn plastic (polylactic acid) in the identification of seven recyclable plastics is new.

105	JCE Classroom Activity #105. A Sticky Situation: Chewing Gum and Solubility. Ingrid Montes-González, Jose A. Cintron-Maldonado, Ilia E. Pérez-Medina, Verónica Montes-Berríos, and Saurie N. Román-López. Journal of Chemical Education 2010 87 (4), 396-397	http://pubs.acs.org/doi/abs/10.1021/ed800135j	In this Activity, students perform several solubility tests using common food items such as chocolate, chewing gum, water, sugar, and oil. From their observations during the Activity, students will initially classify the substances tested as soluble or insoluble. They will then use their understanding of the chemistry of solubility to classify the substances as polar or nonpolar. The chemical concepts reinforced by the Activity include solubility, "like dissolves like", polar and nonpolar, and phases.
106	JCE Classroom Activity #106. Sequestration of Divalent Metal Ion by Superabsorbent Polymer in Diapers. Yueh-Huey Chen, Jia-Ying Lin, Li-Pin Lin, Han Liang, and Jing-Fun Yaung. Journal of Chemical Education 2010 87 (9), 920-921	http://pubs.acs.org/doi/abs/10.1021/ed100415e	This Activity explores an alternative use of a superabsorbent polymer known as a water absorbing material. A dilute solution of $CuCl_2$ is treated with a small piece of unused disposable diaper containing superabsorbent sodium polyacrylates. The polymer is used for the removal of Cu^{2+} ions from the solution. The Cu^{2+} ions in the solution are sequestered through ion exchange with the sodium ions of the insoluble polymer. The solution loses its color, and the polymer gels turn blue. The Cu^{2+} solutions before and after the treatment are further tes+D111ted with soap solution to confirm the action of the polymer.
107	JCE Classroom Activity #107. And the Oscar Goes to...A Chemist! Collin R. Howder, Kyle D. Groen, and Thomas S. Kuntzleman. Journal of Chemical Education 2010 87 (10), 1060-1061	http://pubs.acs.org/doi/abs/10.1021/ed900013z	In the Activity, students compare and contrast the properties of heat conductors and heat insulators. During the demonstration, students learn that water absorbed by a superabsorbent polymer can insulate material from a burning flame. Students also learn about Gary Zeller, a chemist who won an Academy Award for scientific achievement in 1988 for his invention of Zel Jel. Zel Jel is a mixture of water and polymers that is used in the special effects industry to protect actors from being burned when they are set on fire during filming.

108	JCE Classroom Activity #108. Using Archimedes' Principle To Explain Floating and Sinking Cans. Michael J. Sanger. Journal of Chemical Education 2011 88 (3), 272-273	http://pubs.acs.org/doi/abs/10.1021/ed100861h	In this Activity, students (working alone or in groups) measure the mass of several soda cans (diet and regular soda) along with the mass of water that each can displaces. The students are then asked to compare these two mass values for the sinking cans and for the floating cans. The purpose of this activity is for students to determine that the floating cans displace a mass of water roughly equal to the can's mass while the sinking cans displace a mass of water that is less than the can's mass. Students are asked to explain these results using Archimedes' principle, which states that an immersed body is buoyed up by a force equal to the weight of the fluid it displaces.
109	JCE Classroom Activity #109: My Acid Can Beat Up Your Acid! Alice Putti. Journal of Chemical Education 2011 88 (9), 1278-1280	http://pubs.acs.org/doi/abs/10.1021/ed100849b	In this Activity, students investigate the ionization of strong and weak acids. Bead models are used to study acid ionization on a particulate level. Students analyze seven strong and weak acid models and make generalizations about the relationship between acid strength and dissociation.
110	JCE Classroom Activity #110: Artistic Anthocyanins and Acid–Base Chemistry. Jenna Lech and Vladimir Dounin. Journal of Chemical Education 2011 88 (12), 1684-1686	http://pubs.acs.org/doi/abs/10.1021/ed1011647	This Activity illustrates how red cabbage juice, along with other types of produce, can be used to prepare an inexpensive canvas that can be transformed into works of art while using acids and bases to modify the chemical structure of the anthocyanin pigment within the produce. Students will understand the benefits of using natural pigments, investigate how colors can be manipulated, make color gradients, and explore how using different media can affect an individual's artwork. Importantly, students will also develop understanding of the interconnection between science and art.

111	JCE Classroom Activity #111: Redox Reactions in Three Representations. Edgardo L. Ortiz Nieves, Reizelie Barreto, and Zuleika Medina. Journal of Chemical Education 2012 89 (5), 643-645.	http://pubs.acs.org/doi/abs/10.1021/ed100694m	This Activity introduces students to the concept of reduction–oxidation (redox) reactions. To help students obtain a thorough understanding of redox reactions, the concept is explored at three levels: macroscopic, submicroscopic, and symbolic. In this activity, students perform hands-on investigations of the three levels as they work at different stations that support examination and discovery of the general ideas in redox reactions, including oxidizing and reducing agents, and the stoichiometry of a reaction.
112	JCE Classroom Activity #112: Guessing the Number of Candies in the Jar—Who Needs Guessing? Stephanie Ryan and Donald J. Wink. Journal of Chemical Education Article 2012 89 (9); DOI: 10.1021/ed1009943.	http://pubs.acs.org/doi/abs/10.1021/ed1009943	Introducing proportional reasoning to students using a visible and engaging activity provides the opportunity to make the concept clear to students prior to using proportional reasoning in more abstract work. This Classroom Activity uses a popular giveaway game, guessing the number of candy pieces in a jar, to accomplish this goal. At the same time, it introduces students to the idea that different units and types of measurement, such as counting and mass, can be used on the same sample. The activity also includes exercises that link these concepts and skills to counting with atoms and molecules.