Matter and Change

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About **Matter and Change**

DeltaScienceModules, THIRD EDITION

Students explore the chemical makeup, properties, and interactions of substances in thirteen hands-on activities. Activity sheets become lab reports as young chemists hypothesize, test, record, and draw conclusions about the nature of matter. In this chemistry primer, students calculate the densities of liquid and apply filtration and evaporation to suspensions and solutions. They measure gas volumes and pressures to demonstrate Boyle's law. They investigate atomic structure and learn to read the Periodic Table of Elements. With three-dimensional models and corresponding chemical equations, students explore the covalent and ionic molecular bonds of compounds, including the double bonds on fats. Then they conduct three experiments:

- a neutralization reaction between acids and bases
- an oxidation reaction that produces rust
- a double replacement reaction to form a precipitate

In the Delta Science Reader *Matter and Change,* students find out about atomic structure, characteristics of subatomic particles, and different kinds of chemical bonds. They also read about elements and compounds and learn how elements are arranged in the periodic table. They trace changes of state between solid and liquid and between liquid and gas. Students also learn to distinguish physical properties and changes from chemical properties and changes. They read about activation energy, catalysts and inhibitors, and acids and bases. A biographical sketch introduces students to Marie Curie and radioactive elements. Finally, students find out about the history of the atomic model.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 **The Density of Liquids** *page 13*	• measure the mass and volume of three liquids in order to determine their densities • relate the density of a liquid to its ability to keep an object afloat • observe that density can vary among liquids that appear to be similar
2 **Pressure and Volume of a Gas** *page 21*	• measure the volume of a gas as the pressure is increased • graph the relationship between the pressure and volume of a gas • discuss the concept of inverse relationships
3 **Solutions and Suspensions** *page 29*	• differentiate between solutions and suspensions • separate a suspended material from a solution • separate a solute from water
4 **Atomic Structure** *page 37*	• explore the properties of protons, neutrons, and electrons • calculate the number of protons, neutrons, and electrons in an atom, given its atomic number • interpret information on the periodic table • construct model atoms • define *isotope*
5 **Making Molecules** *page 45*	• discover that molecules form through the covalent bonding of atoms • learn that the covalent bonding of two or more different types of atoms forms a covalent compound • observe the symmetrical structure of molecules • build models to demonstrate the three-dimensional structure of molecules
6 **Ionic and Covalent Compounds** *page 53*	• discuss some general characteristics of ionic and covalent compounds • test four substances for their ability to melt, dissolve in water, and conduct electricity • identify the type of compound each substance is made of based on these test results • draw conclusions about the chemical properties of ionic and covalent compounds
7 **Chemical Equations** *page 63*	• discuss reactants and products—the components of a chemical reaction • discover how chemical equations are used to describe chemical reactions • simulate chemical reactions with their models • use their models to help them balance chemical equations
8 **Isomers** *page 69*	• construct molecules of hydrocarbons • deduce that molecules can share the same formula but have different structures • draw and construct isomers of organic compounds
9 **More Organic Compounds** *page 77*	• learn about double bonds • distinguish between saturated and unsaturated fats • correlate the melting point of fats with their degree of saturation
10 **Acids and Bases** *page 85*	• learn the difference between an acid and a base • use an indicator and the pH scale to identify some common household acids and bases
11 **Neutralization** *page 93*	• learn that in the proper amounts bases neutralize acids to form salts and water • perform titrations to neutralize two different acids • determine the relative strengths of two acids by comparing the amount of base solution needed to neutralize each acid
12 **Oxidation** *page 99*	• define *oxidation* • observe an oxidation reaction (in the form of rusting) over time • experiment to determine the factors necessary for oxidation to occur
13 **Precipitates** *page 105*	• predict and observe the outcome of a double replacement reaction • identify a precipitate
Assessment *page 111*	• See page 111.

Process Skills	Vocabulary	Delta Science Reader
measure, collect and record data, infer, observe, interpret data	**density, float height, mass, volume**	pages 13–15
measure, display data, communicate	**Boyle's law, inverse relationship**	pages 10, 13–15
compare, classify, hypothesize, experiment	**evaporation, filtrate, heterogeneous, homogeneous, solute, solution, solvent, suspension**	pages 14–15
investigate, use numbers, interpret data, make and use models, define based on observations	**atom, electron, element, energy level, isotope, neutron, nucleus, periodic table, proton, subatomic particles**	pages 2–5, 22
investigate, make and use models, compare, infer	**covalent bond, covalent compound, molecule**	pages 2–8, 22
communicate, interpret data, experiment, record and analyze data, conclude	**ion, ionic bond, ionic compound**	pages 6–8
communicate, compare, make and use models, investigate	**chemical equation, chemical reaction, product, reactant**	pages 16–19
make and use models, infer, display data	**hydrocarbon, isomer, organic compound**	pages 6–8
compare, classify, conclude	**double bond, fats, saturated, unsaturated**	pages 8, 11, 15
compare, use variables, classify	**acid, base, hydroxide, indicator, pH**	page 20
compare, analyze data, conclude	**neutralization, salt, titration**	pages 16–20
define based on observations, observe, experiment, use variables	**constant, controlled experiment, oxidation, variable**	pages 17–19
predict, observe, investigate, conclude	**precipitate**	pages 17–19

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader
Matter and Change

Selections	Vocabulary	Related Activity
Think About...		
What Makes Up Matter? *pages 2–8* • Atoms • Elements • Compounds	atom, atomic number, chemical bond, chemical formula, compound, covalent bond, electron, element, hydrocarbon, ion, ionic bond, isomer, isotope, mass number, matter, metal, metallic bond, metalloid, molecule, neutron, noble gas, nonmetal, nucleus, organic compounds, periodic table, polar molecule, proton, subatomic, valence electron	Activities 4, 5, 6, 8, 9
How Does Matter Behave? *pages 9–12* • Kinetic Theory of Matter • States of Matter • Matter and Thermal Energy	boiling point, conduction, convection, fluid, gas, heat transfer, kinetic theory of matter, liquid, melting point, plasma, radiation, solid, temperature, thermal expansion	Activities 1, 2, 9
What Are Physical Properties and Changes? *pages 13–15* • Physical Properties • Physical Changes	brittle, colloid, concentration, conductivity, density, dissolve, ductile, hardness, heterogeneous, homogeneous, magnetic, malleable, mass, mixture, physical change, physical property, saturated solution, solubility, solute, solution, solvent, sublimation, suspension, unsaturated solution, volume, weight	Activities 1, 2, 3, 9
What Are Chemical Properties and Changes? *pages 16–20* • Chemical Properties • Chemical Changes	acid, activation energy, base, catalyst, chemical change, chemical equation, chemical property, chemical reaction, combustibility, corrosive, decomposition, endothermic reaction, enzyme, exothermic reaction, hydrogen ion, hydroxide ion, indicator, inhibitor, law of conservation of mass, neutralization reaction, pH, precipitate, product, rate of reaction, reactant, reactivity, salt, stability	Activities 7, 8, 9, 10, 11, 12, 13
People in Science		
• **Marie Curie** *page 21*	radioactive	
Did You Know?		
• **About the Atomic Model** *page 22*	atomic theory	Activities 4, 5

Teaching suggestions for the Delta Science Reader are in a 32-page booklet included with this guide.

MATERIALS LIST

Matter and Change

Quantity	Description
1	alcohol, isopropyl, 1 pt
1	ammonia, 1 pt*
1	baking soda, 4 oz*
1	balloon*
5	balls, foam, black, p/8
4	balls, foam, blue, p/8
4	balls, foam, green, p/8
6	balls, foam, red, p/8
8	balls, foam, white, p/12
8	batteries, 6-V
6	beads, blue, p/8
6	beads, orange, p/8
6	beads, yellow, p/8
8	blocks, foam
8	bulb holder assemblies
8	bulbs
1	calcium chloride, 50 g*
1	charts, Periodic Table, pad/40*
1	copper chloride, 40 g*
2	cups, calibrated, 180-mL
40	cups, plastic, 1-oz
1	Delta Science Dictionary
1	Delta Science Dictionary Copymaster Booklet
24	dowels, wooden
1	filter papers, p/10*
1	fishing line
8	funnels
1	glue, 4 oz*
1	lemon juice, 8 oz*
32	lids for 1-oz cups
32	paper, graph, sheets*
8	petri dishes
2	phenol red, 2 oz*
2	pH papers, p/100*
8	pH scale keys
8	pie pans, aluminum
4	pipe cleaners, 5-cm, p/50
8	pipe cleaners, 40-cm
8	pipe cleaners, 50-cm
48	pipettes
1	poster, Periodic Table of Elements
3	posters, resource
1	potassium iodide, 40 g*
1	salt, 26 oz*
1	sand, 5 oz*
1	sodium carbonate, 50 g*
1	spoon, measuring, 1-Tbsp
24	spoons, plastic
1	steel wool pads, p/6*
80	stirrers, wooden*
8	syringes
4	tape, masking*
1	toothpicks, p/750*
8	troughs, clear, plastic
4	vials, calibrated, 40-mL, p/8
1	vinegar, 16 oz*
1	wax, 1 lb*
8	well plates, 20-well
24	wires, copper, 15-cm, bare
1	**Teacher's Guide**
8	**Delta Science Readers**

TEACHER-PROVIDED ITEMS

Quantity	Description
1	balance
2	butter, unsalted, sticks*
1	clock
–	illustrations of atoms (optional)
1	jar, with lid
1	knife
1	margarine, stick*
1	margarine, tub*
8	marking pencils
1	oil, cooking
1	orange juice, 1 qt*
1	paper towels*
32	paper, white*
3	pitchers, 1-L
1	pot holder
1	quarter
8	rulers, metric
32	safety goggles
1	scissors
1	soft drink, carbonated, clear
2	spoons, stirring
32	textbooks
2	water, distilled, 1 gal*
–	water, tap*

* = consumable item † = in separate box

ACTIVITY SUMMARY

This Delta Science Module introduces students to the world of chemical reactions.

ACTIVITY 1 Students learn about density. First they calculate density mathematically after measuring the volume and mass of three liquids. Then they observe density visually by comparing the ability of the three liquids to keep an object afloat.

ACTIVITY 2 Students explore the inverse relationship between the pressure and volume of a gas. They use the data they obtain from measuring the volume of gas at varying pressures to illustrate this relationship on a graph.

ACTIVITY 3 Students investigate two kinds of mixtures—solutions and suspensions. Students use filtration and evaporation techniques to separate the components of a heterogeneous mixture.

ACTIVITY 4 Students learn about the structure of an atom; the properties of protons, neutrons, and electrons; and the concept of an isotope. They interpret information on the Periodic Table and construct three-dimensional models of atoms.

ACTIVITY 5 Students are introduced to the concept of molecules. They learn that molecules form through the covalent bonding of atoms. After learning about the activity of electrons in covalent bonding, students make models to demonstrate the three-dimensional structure of molecules.

ACTIVITY 6 Students distinguish between covalent and ionic compounds. They observe the melting point, solubility, and conductivity of various substances to see how the type of bond between atoms in a compound affects the characteristics of that compound.

ACTIVITY 7 Students learn how chemical equations are used to describe chemical reactions. Students use three-dimensional models to simulate some chemical reactions and then balance the chemical equations that describe those reactions.

ACTIVITY 8 Students use model molecules to explore isomers of a group of organic compounds known as hydrocarbons. They construct model hydrocarbon molecules and deduce that two molecules can have the same chemical formula but different molecular shapes.

ACTIVITY 9 Students are introduced to another group of organic compounds: fats. They distinguish between saturated and unsaturated fats and explore the effect of double bonds on their melting points.

ACTIVITY 10 Students explore the family of chemicals known as acids and bases. Through the use of an indicator, students measure the pH of some common household substances and identify them as acids or bases.

ACTIVITY 11 Students continue their study of acids and bases as they discover that bases neutralize acids to form salts and water. They determine the relative strength of two acids by comparing the amount of base solution needed to neutralize each acid.

ACTIVITY 12 Students observe an oxidation reaction in the form of rusting. They conduct a controlled experiment in order to determine the factors necessary for oxidation to occur.

ACTIVITY 13 Students carry out a double replacement reaction and observe the formation of a precipitate.