It's Still All About Matter!

Grade Level: 5th Grade
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Length of Unit: Six Lessons

I. ABSTRACT

This unit is intended to provide fifth graders with an overview of Chemistry and to provide their teachers with lessons to cover all of the fifth grade Chemistry requirements in the *Core Knowledge Sequence*. Through observation and hands on activities, the students will gain a foundation for their understanding of the exciting world of matter. The unit uses a variety of approaches to learning, including making models, doing experiments and investigations, and developing a Science Journal. This unit is specifically written to build on the 4th grade Chemistry unit from 2002 called "It's All about Matter" written by Marcia Honer.

II. OVERVIEW

A. Concept Objectives
   1. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process. (Jefferson County Schools Science Content Standard # 2)
   2. Know and understand common properties, forms, interactions, and transformations of matter and energy. (Jefferson County Schools Science Content Standards # 6)

B. Content from the *Core Knowledge Sequence* (page 129)
   1. Atoms
      a. Basics of atomic structure: nucleus, protons (positive charge), neutrons (negative charge), neutrons (neutral), and electrons (negative charge). (Review from fourth grade unit)
      b. Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels). (Review from fourth grade unit)
      c. Atoms may join together to form molecules and compounds
      d. Common compounds and their formulas:
         i. Water—H_2O
         ii. Salt—NaCl
         iii. Carbon dioxide—CO_2
   2. Elements
      a. Elements have atoms of only one kind, having the same number of protons. There are a little more than 100 different elements. (Review from fourth grade)
      b. The Periodic Table: organizes elements with common properties
         i. Atomic symbol and atomic number (Review from fourth grade)
      a. Some well-known elements and their symbols—Oxygen-O, Aluminum-Al, Iron-Fe, Copper-Cu, Gold-Au, (review from fourth grade) and Hydrogen-H, Helium-He, Carbon-C, Nitrogen-N, Sodium-Na, Silicon-Si, Chlorine-Cl, Silver-Ag
      b. Two important categories of elements: metals and non-metals
         i. Metals comprise about 2/3 of the known elements.
         ii. Properties of metals: most are shiny, ductile, malleable, and conductive.

3. Chemical and Physical changes
    a. Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour.
    b. Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water.

C. Skill Objectives
1. Students will use classifying strategies to arrange elements by the method by which they were named.
2. Students learn common elements and their symbols.
3. Students will be able to build a model of each of eight elements. (Five have been built in fourth grade.)
4. Students will observe the properties of two elements.
5. Students will interpret the data from the investigation.
6. Students will apply classification strategies to two elements.
7. Students will identify the process of physical change.
8. Students will identify the process of chemical change.
9. Students will identify the elements in common compounds by reading their chemical formulas.

III. BACKGROUND KNOWLEDGE

A. For Teachers
1. Basic information for teachers is included in the lesson procedures. Additional information can be learned from RESOURCES.

B. For Students
1. *Core Knowledge Sequence*, page 38, First Grade Science
2. *Core Knowledge Sequence*, pages 104-05, Fourth Grade Science

IV. RESOURCES

A. Frank, D. V., Little, J. G., & Miller S. *Science Explorer: Chemical Building Blocks*. Teacher's Edition. New Jersey: Prentice-Hall, Inc., 2002. ISBN 0-13-429200-6.

B. Frank, D. V., Little, J. G., & Miller S. *Science Explorer: Chemical Interactions*. Teacher's Edition. New Jersey: Prentice-Hall, Inc., 2002. ISBN 0-13-434562-2

C. Ward, P. & Ward, B. *The Atom*. Mark Twain Media, Inc. 1995. ISBN 1-58037-054-3

V. LESSONS

Lesson One: Elements

A. *Daily Objectives*
1. Concept Objective(s)
    a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.
2. Lesson Content
    a. The Periodic Table: organizes elements with common properties
    b. Some well-known elements and their symbols—Oxygen-O, Aluminum-Al, Iron-Fe, Copper-Cu, Gold-Au, (review from fourth grade) and

Hydrogen-H, Helium-He, Carbon-C, Nitrogen-N, Sodium-Na, Silicon-Si, Chlorine-Cl, Silver-Ag

3. Skill Objective(s)
   a. Students will use classifying strategies to arrange elements by the method by which they were named.

B. *Materials*
1. Ten one inch paper squares of each of each color (red, blue, yellow, green) for every two students
2. Copy of Periodic Table for each student
3. Copy of Appendix A for each student
4. Science Folder with brads and notebook paper; students will use the folder to take notes and to keep handouts throughout the unit; all teacher handouts should be three hole punched (Students may have their folder from 4th grade. This makes review easier for both student and teacher.)

C. *Key Vocabulary*
1. System-an orderly grouping of items
2. Periodic Table-a chart (system) of elements grouped according to similar properties
3. Properties-characteristics that make each element unique

D. *Procedures/Activities*
1. Give each pair of students a set of squares of each color. Have students number each color set from one to ten. Mix all four sets together. Arrange squares so numbered sides are face up. One partner names a square by color and number and measures the time it takes for the other partner to find the square. Record time, then mix the squares and repeat two more times. Average the three times to find the average. Partners trade places and repeat the activity. Then arrange the squares in number order in rows by colors. One partner names a square by color and number and measures the time it takes the other to find the square. Record the time and repeat two times. Average the times. Trade places and repeat activity. Which time was shorter? Why? What other ways could the squares have been organized? Encourage students to create different systems of organization and discuss strengths and weaknesses of each system. Why would scientists feel it important to organize elements? (Activity adapted from *Science Explorer—Chemical Building Blocks*) This activity can be used to introduce or reinforce the skill of classifying which will be taught in the unit on Classifying Living Things (*Core Knowledge Sequence*, page 126.)
2. Pass out copies of the Periodic Table and have students place in their Science Folder. Give students the opportunity to examine the table. Point out the elements Mercury, Einsteinium, and Californium. Have students brainstorm why these were named? Can they find others named in a similar manner? Have students name possible categories that some of the elements could be placed in. (Possibilities include: names of famous scientists, geographical names, and names of planets. Have the students include a "?" category for elements that do not fit the other categories.)
3. Pass out copies of Appendix A. Have students fill in the category boxes; then see how many elements they can place under each category. Have students research the elements they place in the "?" category to see how they were named. Students can use an encyclopedia or various trade books to find out how different elements were named. Many will have Greek or Latin roots (bromine comes from the Greek word for "bad smell" and the Latin word for gold is aurum.)

E. *Assessment/Evaluation*
   1. Grade Appendix A. Return to students and have it placed in the Science Folder.

Lesson Two: Symbols of Thirteen Elements

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.
      b. Know and understand common properties, forms, interactions, and transformations of matter and energy.
   2. Lesson Content
      a. Some well-known elements and their symbols—Oxygen-O, Aluminum-Al, Iron-Fe, Copper-Cu, Gold-Au, (review from fourth grade) and Hydrogen-H, Helium-He, Carbon-C, Nitrogen-N, Sodium-Na, Silicon-Si, Chlorine-Cl, Silver-Ag
   3. Skill Objective(s)
      a. Students learn common elements and their symbols.

B. *Materials*
   1. Appendix A from previous lesson
   2. Unlined 3" X 5" note cards cut in half vertically or similar sized paper pieces- 13 for each child

C. *Key Vocabulary*
   1. Symbol-one or two letters used to identify an element

D. *Procedures/Activities*
   1. Tell students that scientists all over the world use the Periodic Table. These scientists speak many different languages and need to be able to communicate in a common language. The Periodic Table is the same all over the world. The symbols for the elements are the same no matter which language a scientist speaks.
   2. Pass out the cut note cards. Have the students refer to Appendix A to see how these thirteen elements were named. Have students put the name of each element on one side of the card and the symbol on the reverse. This is the time to reiterate that many of these elements are given Greek and Latin names and their symbols reflect those names. Also tell the students that the first letter of the symbol is always capitalized and the second letter is always lower case. These are flash cards for learning the symbols required in the *Core Knowledge Sequence*. Tell students that a quiz over these elements and symbols will be taken later in the unit.

E. *Assessment/Evaluation*
   1. Quiz over elements and symbols (Appendix B)

Lesson Three: Construct Models (two 40 minute sessions)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct,

communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.

b. Know and understand common properties, forms, interactions, and transformations of matter and energy.

2. Lesson Content
   a. Basics of atomic structure: nucleus, protons (positive charge), neutrons (negative charge), neutrons (neutral), and electrons (negative charge). (Review from fourth grade unit.)
   b. Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels). (Review from fourth grade unit.)
3. Skill Objective(s)
   a. Students will be able to build a model of each of eight elements. (Five have been built in fourth grade.)

B. *Materials*
1. Appendix C-two copies for each student and a transparency for teacher
2. Appendix D-one copy for each student and a transparency for teacher
3. Appendix E-two copies for each student and a transparency for teacher
4. Appendix F-three for each student and a transparency for teacher
5. Color-coding dots from office supply store (for each student, you will need 53 half-inch in red (protons), 53 half-inch in blue (neutrons) and 53 one-fourth inch dots in green (electrons))
6. Red, blue, and green Vis a Vis pens
7. Science Folder to insert each model after construction

C. *Key Vocabulary*
1. Electron Cloud Theory-current model of atomic structure where electrons orbit the nucleus in energy levels called shells (these shells are three-dimensional regions of space, not lines as shown in many drawings of atomic structure)

D. *Procedures/Activities*
1. Review atomic structure (protons, neutrons, electrons, nucleus and shells from fourth grade).
2. Using transparency of Appendix C and the Vis a Vis pens, teacher will demonstrate the structure of a carbon atom. Draw six red dots in the nucleus of the atom to represent the protons. Add six blue dots to represent the neutrons. Make sure that you scatter both colors throughout the nucleus. Draw two of the green dots in Shell One to represent the electrons. Make sure these dots are opposite each other in the ring of the shell (like charges repel.). Add four electron dots to Shell Two. Space electrons around the shell (again, like charges repel and electrons will stay away from other electrons). Discuss with the students that this is a model of an atom of carbon according to the Electron Cloud Model (see Appendix H for Key).
3. Repeat procedure with the transparency of Appendix D to make a model of an atom of silver. Use 47 dots for the protons, 61 dots for the neutrons and 47 dots for the electrons. Place two electron dots in Shell One, eight in Shell Two, eighteen in Shell Three, eighteen in Shell Four and one in Shell Five. Handout copies of Appendix D and have students place dots appropriately. This is the most complex model constructed in fifth grade.
4. Hand out colored dots and two copies of Appendix E. Have students make the model of the helium atom using their colored dots (two protons, two neutrons and two electrons in Shell One.) Teacher will use the transparency to complete model so students can self-check for accuracy. Repeat with the model of hydrogen, explaining that the hydrogen atom is the only known element that has

no neutrons. Each model will contain one proton in the nucleus and one electron in Shell One. Students should self-check.

5. Hand out copies of Appendix C. Have students make a model of a nitrogen atom using seven protons, seven neutrons, two electrons in Shell One, and five electrons in Shell Two.
6. Hand out three copies of Appendix F for each student. Have students make model of a sodium atom using eleven protons, twelve neutrons, two electrons in Shell One, eight electrons in Shell Two and one in Shell Three. The silicon model is constructed with fourteen protons, fourteen neutrons, and two electrons in Shell One, eight in Shell Two and four electrons in Shell Three. Teacher should monitor student work for accuracy and then have students place in folder.

E. *Assessment/Evaluation*

1. Using the last copy of Appendix F, students will construct a model of the chlorine atom to be graded for accuracy. Model uses seventeen protons, eighteen neutrons, two electrons in Shell One, eight in Shell Two and seven in Shell Three. Grade and return to students to be placed in Science folder.

Lesson Four: Metals, Non-Metals and Metalloids

A. *Daily Objectives*

1. Concept Objective(s)
   a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.
   b. Know and understand common properties, forms, interactions, and transformations of matter and energy.
2. Lesson Content
   a. Two important categories of elements: metals and non-metals
   b. Metals comprise about 2/3 of the known elements.
   c. Properties of metals: most are shiny, ductile, malleable, and conductive.
3. Skill Objective(s)
   a. Students will observe the properties of two elements.
   b. Students will interpret the data from the investigation.
   c. Students will apply classification strategies to two elements.

B. *Materials*

1. Student Science Folder containing the Periodic Table
2. Transparency of Periodic Table
3. Investigation materials (for each group):
   a. 1.5-V dry cell
   b. 200 mL beaker
   c. Stopwatch
   d. Flashlight bulb and bulb holder
   e. Three lengths of insulated copper wire, two twelve inches long and one six inches long
   f. Thin copper wire with no insulation, 5-6 cm long
   g. Graphite samples (lead from a mechanical pencil), each about 5-6 cm long-one for each member of the group plus one extra
   h. Safety goggles
   i. Hot plate
   j. Water

k. Discovery Sheet (Appendix G) for each student

C. *Key Vocabulary*

1. Metal-elements classified by the properties of shininess, ductility, malleability, and conductivity
2. Nonmetal-elements classified as the opposite of metals; their properties include dullness, brittleness (they are not malleable or ductile) and poor conductibility
3. Metalloid-elements that have some of the properties of a metal and some of the properties of a non-metal
4. Ductility-ability to be stretched into a wire
5. Malleability-ability to be hammered or rolled into shape
6. Conductivity-ability to transmit heat and/or electricity easily
7. Insulated wire-wire coated to prevent loss of electricity

D. *Procedures/Activities*

1. Have students take notes in their Science Folder. Remind students that all matter is made up of elements. There are 109 known elements at this time. About two/thirds of the known elements are classified as metals according to the properties of the element. (Review definition of properties from previous lesson.) Students will understand the property of shininess but will need a discussion on the meaning of ductility, malleability and conductivity. Introduce the concept of nonmetals and their properties: dullness, brittleness (tendency to break and shatter instead of bend) and poor conductivity of electricity and heat. Have students refer to their Periodic Table. Show students the dividing line between the metals and the nonmetals. Point out the metalloids on both sides of the stair step line. These elements may have some of the properties of metals and some of the properties of nonmetals. The most common metalloid is silicon (Si), which is used to make semiconductors for computers, transistors and lasers. Under certain conditions, silicon will conduct electricity and under other conditions, it will not.
2. This Discovery Sheet can be divided so students can do the heat conduction activity with adult supervision. (You decide how much you can trust your kids!) Divide students into groups. Have groups work on other discovery activities while one group at a time moves to the heat transfer activity under adult supervision. Pass out Appendix G and have groups complete the investigation. Be sure that students write answers in complete sentences so that you can determine how well they understand the concepts. Urge them to use words other than the ones in the first column in order to demonstrate understanding of the concepts. The last row can be a homework assignment to see how many different uses of each material could be found. Investigation was adapted from *Science Explorer: Chemical Building Blocks*, pages 94 and 95.

E. *Assessment/Evaluation*

1. Completion of Appendix G

Lesson Five: Physical and Chemical Change (three or four 40 minute lessons)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.
   b. Know and understand common properties, forms, interactions, and transformations of matter and energy.

2. Lesson Content
    a. Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour.
    b. Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water.
3. Skill Objective(s)
    a. Students will identify the process of physical change.
    b. Students will identify the process of chemical change.

B. *Materials*
1. Appendix H-Transparency for teacher
2. Science Folders
3. Activity 1 and 5—Bread machine, bread mix, water, measuring cup, cutting board, bread knife
4. Activity 2—Board approximately 1 X 24 inches, saw
5. Activity 3—Ice cubes, saucepan, hot plate, large mirror with handle
6. Activity 4—newsprint, plate, 200 mL beaker or similar container, water
7. Activity 6—Candle, holder or pie pan, matches, metal spoon, glass jar (quart size)
8. Activity 7—Plain steel wool, vinegar, glass jar (about quart size) with lid, water
9. Activity 8-Student activity- Each group needs three transparent plastic cups, three cups water, ¼ c salt, ¼ c sugar, two plastic spoons, and two Alka Seltzer tablets (I do activity on foam meat trays lined with paper towels)

C. *Key Vocabulary*
1. Physical change- action that changes the appearance of the substance but not the substance itself
2. Chemical change- action that creates new substance

D. *Procedures/Activities*
1. Start the day with a bread machine baking bread in the back of the room. Do not answer questions and only say that you will use the bread later in the day. The sound of the kneading process and the smell of the baking bread will cause many questions but just smile and say, "You'll see!" Time the baking process so that the bread will be cool enough to slice at the end of the science class.
2. Place the transparency of Appendix H on the overhead. Students should enter information for each of the following activities in their Science Folders. (I've found it easier for the students to organize if each activity is entered on a separate page.) This form is used for a discovery (the students KNOW what the activity is going to show) but can easily adapted to fit an experiment. Many students will want to go home and show their families what they have learned. I have found that many forget an important step in the procedure or a necessary material. It is a good review process for students to complete an activity they have seen or have completed as a group. Have students state purpose and outcome in complete sentences. Review the **SCIENCE** of each activity to insure that each student understands how it fits into the lesson. Give students one of these worksheets and have them use the format for all the other activities.
3. Show the class a board. Discuss that the board came from a tree and that the sawing of the board has not changed the substance that the board is made of. Saw the board into two pieces, one larger than the other. Ask if the change in size has changed the substance of the board. Have students examine the sawdust.

Once again, discuss whether the change in the physical appearance has changed the substance. (The sawing may be done before class but is much more impressive when done in front of the students. Students may do the sawing if closely monitored by the teacher.) Have students record process and understanding of concept in Science Folder.

4. Then demonstrate the phase changes of water. Place ice cubes in a pan. Put the pan on a hot plate and melt the ice cubes. Discuss with the students that adding heat energy to matter changes the phase that the matter is in but the matter itself does not change. As the water begins to boil, point out the water vapor that is formed. Angle a mirror over the pan long enough to have the vapor condense back into water. Drops of water will run down the surface of the mirror. Ask students what needed to happen to the water vapor to return it to the water state (Heat energy needed to be removed to condense vapor back to water.). This is an example of a phase change but the substance itself has not changed. The substance still remains H_2O. Have students record understanding of concept and process in Science Folder.
5. Show students a sheet of newsprint (not newspaper because the ink will run). Tear the page in half. Place half on a plate and pour water over the paper. Discuss with the students that if the paper is left in the plate undisturbed, the water will evaporate but the substance of the paper will not change. Tear the remaining half sheet into increasingly smaller pieces. Each time ask the students if the substance has changed. (No) Place the pieces in a beaker and cover with water. Stir vigorously; then ask if the substance of the paper has changed. (No) Gather the pulp in your hand, squeezing as much water from the wad of paper as you can. Ask again if the substance of the paper has changed. (No) When all the water has evaporated, the physical appearance of the paper has changed but not the substance itself. (Do this activity ahead of time and be able to show students a dried sheet of paper on a plate and a dried wad of paper from a beaker.) Once again, this is an example of physical change. Have students record in folder.
6. Now slice the bread and give each student a slice. (If time allows, you could have the students make butter in quart jars and spread on the bread.) Display the ingredients used to prepare the dough. Discuss how these ingredients were mixed and then baked. Ask students if the bread is the same substance as the ingredients (No). Can they be returned to their original state? (No) This is an example of a chemical change. Have students record concept and understanding in folder.
7. Light a candle placed in a holder or on an aluminum pie pan held in place with modeling clay. Hold a metal spoon over the flame for only a few seconds and then display the bottom of the spoon. Allow students to rub a **little** of the carbon on their fingers. Question whether this is an example of a physical change, phase change, or a chemical change. This is an example of a chemical change. The candle wax is a chemical compound of hydrogen and carbon. The flame (heat) separates the hydrogen from the carbon and the carbon is deposited on the bottom of the spoon. Where has the hydrogen gone? (It is released into the air.) Continue the demonstration by inverting a glass jar over the candle flame for about 30 seconds. Ask students to observe what happens inside the jar. Students should see moisture condense on the sides of the jar. The hydrogen has combined with the oxygen in the air to form H_2O—water. Have students record in folder.
8. Place a pad of plain steel wool (the kind without soap) in a jar. Cover with vinegar and let stand overnight. Have students use their knowledge of physical

and chemical change to predict the purpose and result of the demonstration. This is a good place to end the day's lesson. The next day, remove the steel wool and rinse with water. Place in the jar; add a few drops of water, and cover. Record observations for the next three days. The iron in the steel wool combines with the oxygen in the air to form a new substance—iron oxide which we call rust. This is an example of chemical change. Have students record in folder.

9. Student Activity: Give each group three plastic cups. Label cups A, B, and C with a permanent marker. Pour eight ounces of room temperature water in each cup. Into cup A, pour ¼ c. salt and into cup B, pour ¼ c. sugar. Stir until salt and sugar are dissolved and the water becomes clear. Into cup C, drop two Alka Seltzer tablets. Observe the difference between cups A and B and cup C. Students should record procedure and observations in folders. Have students predict if each solution is an example of physical change or chemical change. Place cups in a safe place (I have students do activity on large foam meat trays lined with paper towels. Group names are written on the towels and the trays are used to transport cups from the science table to the group desks.) Record observations of the cups over three to five days. As evaporation occurs, crystals of salt and sugar will form on the sides of the cups. This is an example of physical change because the salt and sugar are unchanged and the water has changed phase (to a gas) but not chemically. Dry salts will form on the sides of cup C but this is an example of a chemical change. The bubbles released during the dissolving process were carbon dioxide that was created from starch in the tablets and oxygen from the water. Because this gas was released the substances are not the same as they were before the change. This is an example of Chemical change.

E. *Assessment/Evaluation*
   1. Check folders of student records for concept and process

Lesson Six: Compounds

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that science is a framework for understanding the natural world based on experimentation and logical analysis. Understand the processes of scientific investigation and be able to design, conduct, communicate, and evaluate such investigations. Use the understanding of science in a decision-making process.
      b. Know and understand common properties, forms, interactions, and transformations of matter and energy.
   2. Lesson Content
      a. Atoms may join together to form molecules and compounds
      b. Common compounds and their formulas:
         i. Water—H_2O
         ii. Salt—NaCl
         iii. Carbon dioxide—CO_2
   3. Skill Objective(s)
      a. Students will identify the elements in common compounds by reading their chemical formulas.

B. *Materials*
   1. Science Folders
   2. Copy of Appendix I for each student

B. *Key Vocabulary*

1. Compound-the joining of two or more kinds of atoms into a molecule by a chemical reaction
2. Molecule- particle of two or more atoms bonded together
3. Bond-the force that holds atoms together to form a molecule
4. Chemical reaction- change that occurs when chemical bonds break or new bonds form
5. Formula- a combination of symbols of elements that represent a compound
6. Subscript- number that shows the number of atoms of an element in a formula

C. *Procedures/Activities*

1. Review understanding of atom structure including the Electron Cloud Theory. Tell students that the force holding the electrons weakens as their distance from the nucleus increases. Only the electrons in the outer shell are used in the formation of a compound. If the outer shell is full or almost full, the element is not likely to form compounds. Have students refer to the sodium atom model in their science folder. How many electrons are in the outermost shell? (1) Then refer to the chlorine atom. How many atoms are in the outer shell? (7) These two elements are easily attracted to each other. The atoms will move close enough together to share the atoms in their outer shell. They bond together to form a new substance-sodium chloride. Tell students that both sodium and chlorine **as elements** are poisonous to humans. If a person breathes in chlorine gas or swallows a lump of sodium, he would die. But when the sodium and chlorine are bonded together, the new substance is called sodium chloride or table salt. Salt is necessary for our bodies to work correctly. The formula for this new substance is NaCl, which means that one atom of sodium is bonded to one atom of chlorine. This is an example of two elements combining to form a new substance. Draw model on board or overhead projector. Have students draw into their Science Folders.
2. Most students know that the formula for the compound water is H_2O. In nature, oxygen atoms bond in pairs. In order to form a molecule of water, four atoms of hydrogen are necessary to bond with the two oxygen atoms. The formula shows that each molecule has two atoms of hydrogen bonded to each atom of oxygen. The number 2 is written as a subscript (sub means below; script means written). This is another example of two elements bonding to form a new substance—a compound. Have students decide what a model of a molecule of water would look like. Draw model on board or overhead projector and have students copy in Science Folders.
3. The chemical formula for carbon dioxide is CO_2. Remind students that CO_2 is a by-product of the respiration process and is commonly present in air. It is also what makes the bubbles in soda. Carbon monoxide (CO) is a colorless, odorless gas that is a deadly poison. Have students draw both models in their Science Folders.

D. *Assessment/Evaluation*

1. Teacher check of student folders
2. Grade Appendix I

VI. HANDOUTS/WORKSHEETS

A. Appendix A: Elements Table
B. Appendix B: Elements and Symbols Quiz
C. Appendix C: Atom Model with Two Shells
D. Appendix D: Atom Model with Five Shells

E. Appendix E: Atom Model with One Shell
F. Appendix F: Atom Model with Three Shells
G. Appendix G: Discovery Sheet-Metals
H. Appendix H: Science Discovery Sheet
I. Appendix I: Compounds
J. Appendix J: Answer Key for Appendix I

VII. BIBLIOGRAPHY

A. Bouffard, D. *Solids, Liquids & Gases*. St. Louis, Missouri: Milliken Publishing Co. 1984. ISBN 0-88335-810-7
B. Chisholm, J. & Johnson, M., *Chemistry*. London, Usborne Publishing, Ltd., 1983. ISBN 0-86020-709-9
C. Cox, P. & Parsonage, M., *Atoms and Molecules*. London, Usborne Publishing, Ltd., 1992. ISBN 0-7460-0988-7
D. Frank, D. V., Little, J. G., & Miller S. *Science Explorer: Chemical Building Blocks*. Teacher's Edition. New Jersey: Prentice-Hall, Inc., 2002. ISBN 0-13-429200-6.
E. Frank, D. V., Little, J. G., & Miller S. *Science Explorer: Chemical Interactions*. Teacher's Edition. New Jersey: Prentice-Hall, Inc., 2002. ISBN 0-13-434562-2
F. Hensey, H., & Crocker, M. *What's the Matter?* Core Knowledge Foundation
G. Hixson, B., *Chem Toobe Ticklers*, Utah, Loose in the Lab, Inc., 1988, ISBN 0-9660965-9-5
H. Hixson, B., *The Super Slurper Slime Co.*, Utah, Loose in the Lab, Inc., 1988, ISBN 0-9660965-9-5
I. National Science Teachers Association, *The Periodic Table*, www.nsta.org
J. Newton, D. E. *Chemical Elements: From Carbon to Krypton.* Michigan: The Gale Group, ISBN 0-7876-2844-1
K. Nye, B., *Bill Nye the Science Guy's Big Blast of Science*. New York: Scholastic Inc., 1993. ISBN 0-590-61593-9
L. Prentice-Hall, Inc. *Science Explorer.* www.phschool.com
M. Radar, Andrew Studios. *Chem4Kids.* www.chem4kids.com
N. Richards, J. *Science Factory: Chemicals & Reactions*. Connecticut: Cooper Beech Books, 2000, ISBN 0-7613-0935-7
O. Royal Society of Chemistry, *The Visual Elements Periodic Table*. www.chemsoc.org
P. Scott-Taylor, G. *Phase Changes: Heat and Matter* Core Knowledge Foundation
Q. Ward, P. & Ward, B. *The Atom*. Mark Twain Media, Inc. 1995. ISBN 1-58037-054-3
R. Wiley, D. & Royce, C., *Physical Science*, Michigan, Instructional Fair, ISBN 1-56822-479-6

APPENDIX A-It's Still All About Matter

Name_____#_____

Complete the table. Choose the categories for which elements have been named. Fill those categories in the top row of boxes. Under the category, list elements and what they were named for.

Elements named for_____	Elements named for_____	Elements named for_____	?

APPENDIX B-It's Still All About Matter

Name_____02_____#___

Elements and Symbols Quiz

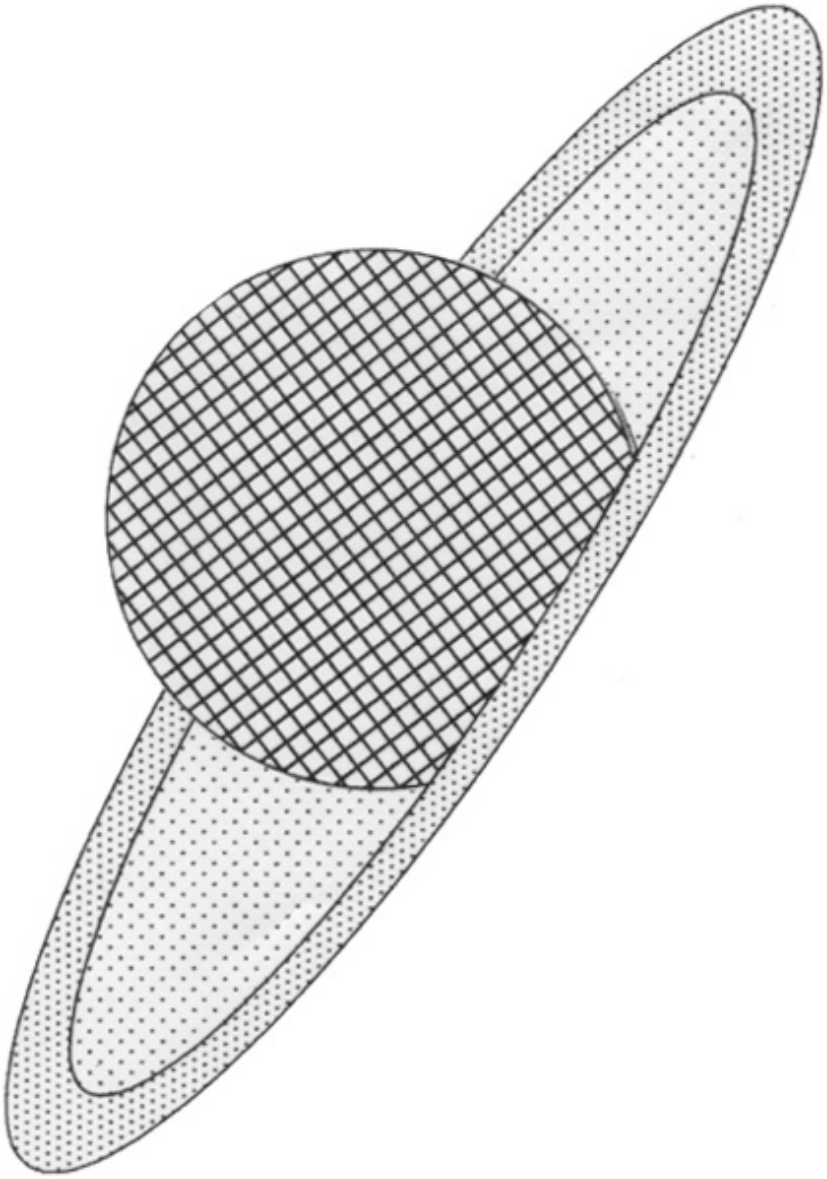
Name the symbol for the elements given or the element for the symbol given.

1. Silver_____
2. C_____
3. Chlorine_____
4. Au_____
5. Silicon_____
6. H_____
7. Copper_____
8. Aluminum_____
9. O_____
10. Iron_____
11. Sodium_____
12. N_____
13. He_____

APPENDIX C-It's Still All About Matter

Atom Model with Two Electron Shells

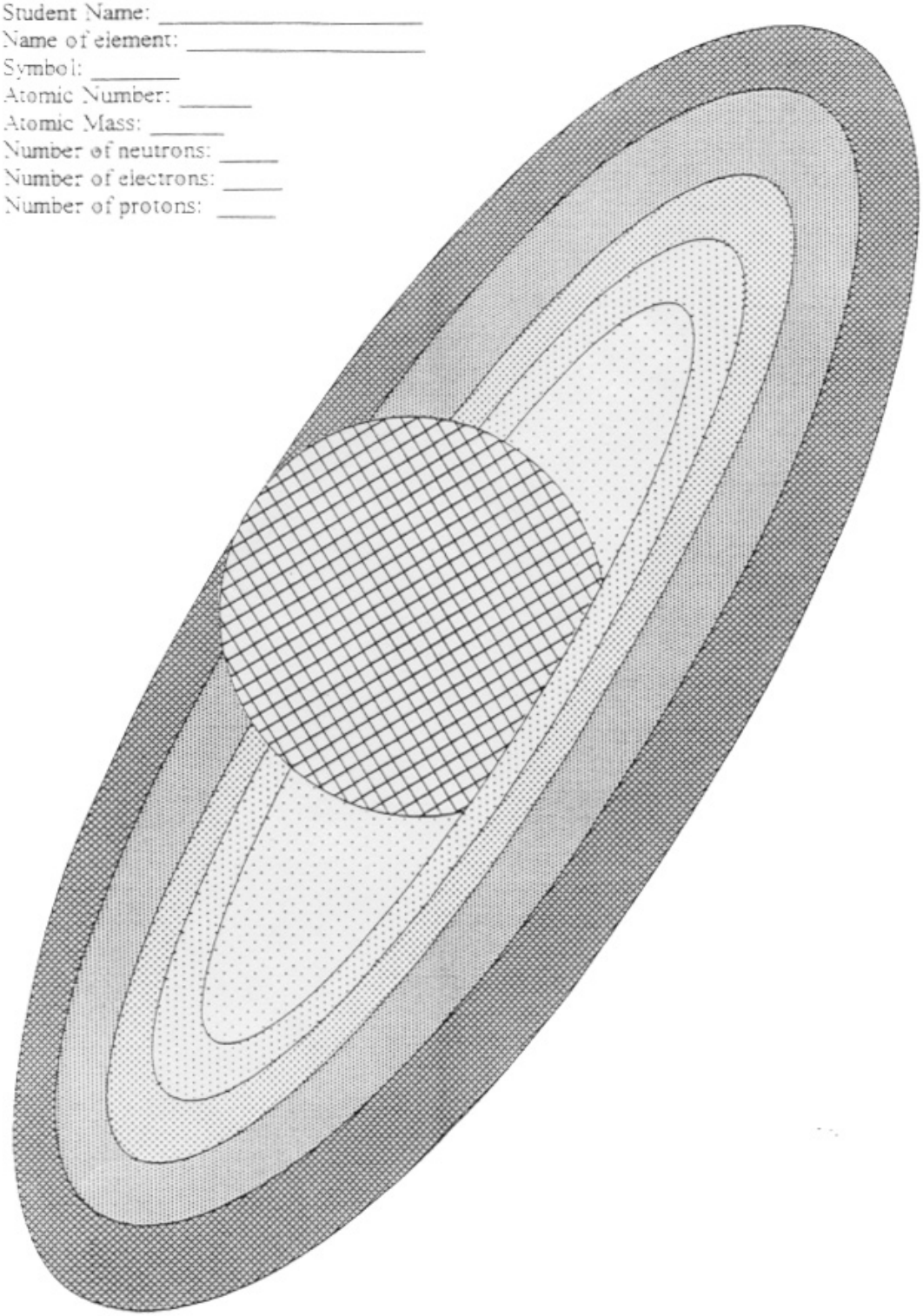
Student Name: _____
Name of element: _____
Symbol: _____
Atomic Number: _____
Atomic Mass: _____
Number of neutrons: _____
Number of electrons: _____
Number of protons: _____



APPENDIX D-It's Still All About Matter

Atom Model with Five Electron Shells

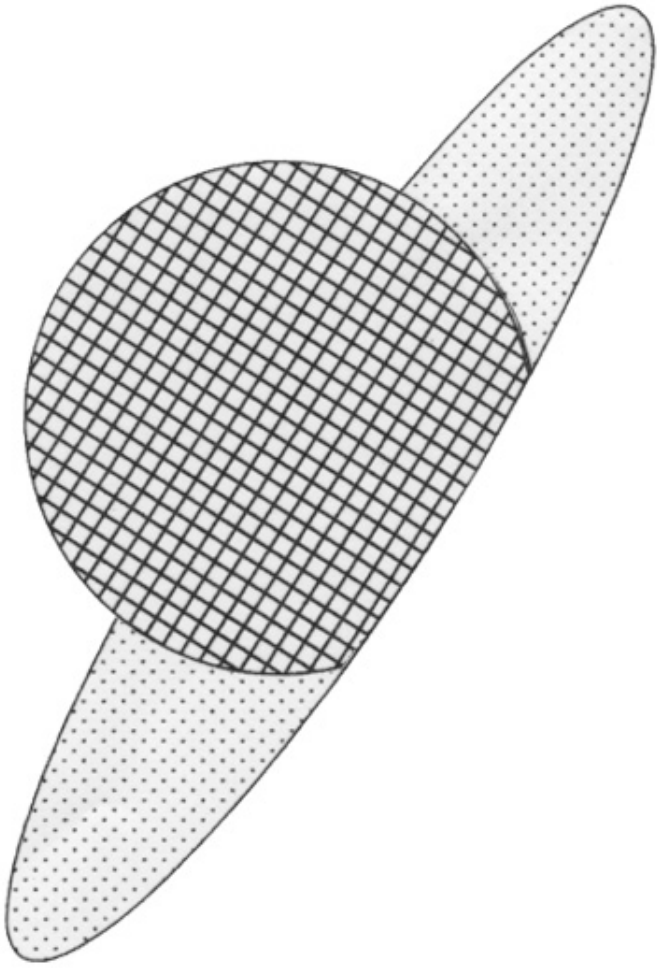
Student Name: _____
Name of element: _____
Symbol: _____
Atomic Number: _____
Atomic Mass: _____
Number of neutrons: _____
Number of electrons: _____
Number of protons: _____



APPENDIX E-It's Still All About Matter

Atom Model with One Electron Shell

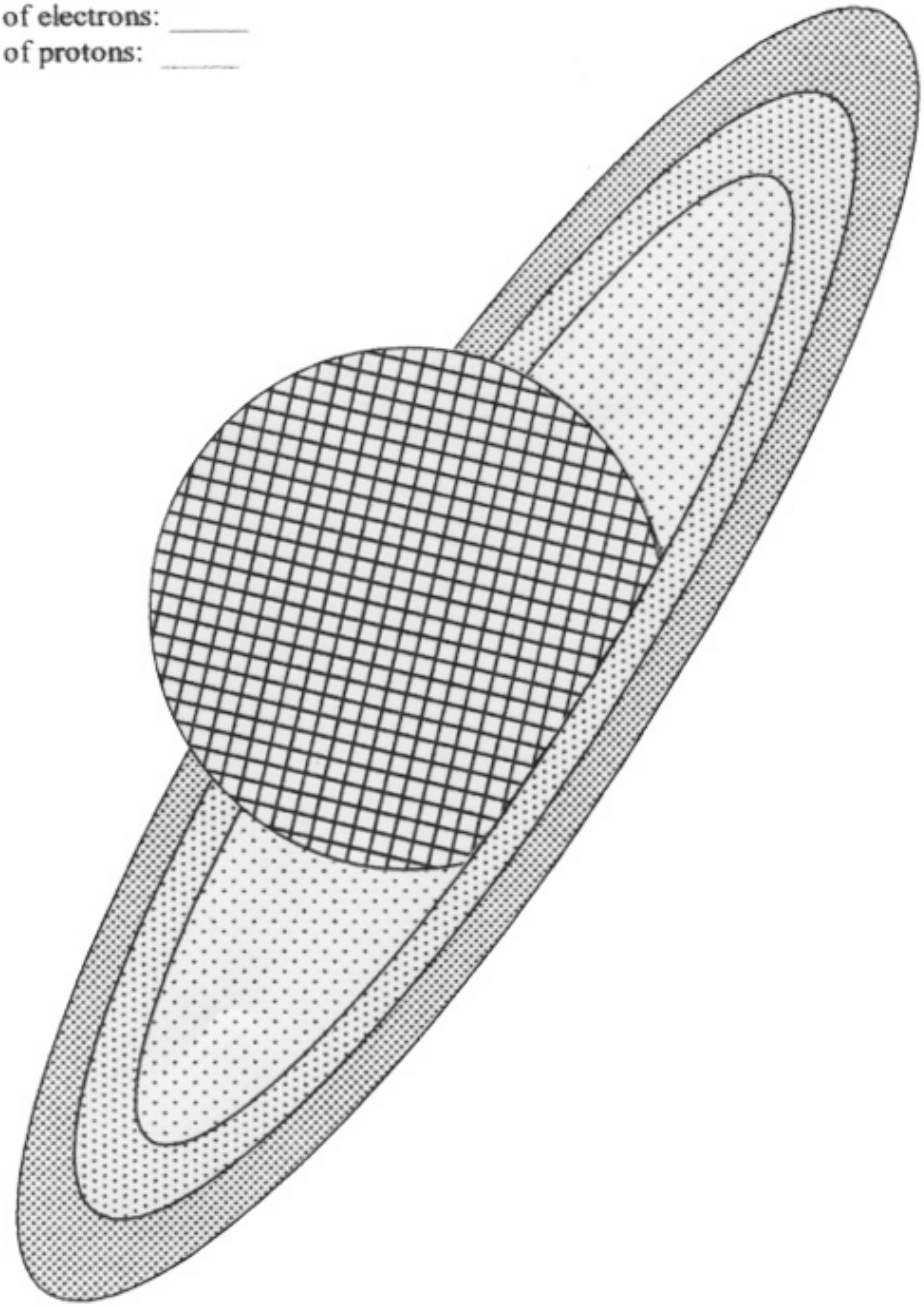
Student Name: _____
Name of element: _____
Symbol: _____
Atomic Number: _____
Atomic Mass: _____
Number of neutrons: _____
Number of electrons: _____
Number of protons: _____



APPENDIX F-It's Still All About Matter

Atom Model with Three Electron Shells

Student Name: _____
Name of element: _____
Symbol: _____
Atomic Number: _____
Atomic Mass: _____
Number of neutrons: _____
Number of electrons: _____
Number of protons: _____



APPENDIX G-It's Still All About Matter
Discovery Sheet-Metals

Name_____

Purpose: To compare the properties of copper wire and graphite.

Procedure:

1. Fill a heatproof 200 mL beaker about 2/3 full of water. Place on a hot plate and heat slowly while you complete the rest of the investigation.
2. Compare the shininess and color of your two samples. Record.
3. Bend the copper wire as far as possible, then bend one sample of the graphite. Record observations.
4. Place bulb in socket. Connect one pole of the battery to the bulb socket with one of the longer wires.
5. Connect a second long piece of insulated wire to the battery and leave the end unconnected.
6. Connect the other pole of the bulb holder with the shorter length of insulated wire. Leave the other end unconnected.
7. Touch the unconnected ends of the insulated wire together. Record your observations of the bulb.
8. Then touch the unconnected end of the battery wire to one end of a graphite sample. Touch the unconnected end of the bulb holder wire to the other end of the graphite sample. Record your observations of the bulb.
9. Turn off the hot plate. Hold one end of the graphite sample between the thumb and first finger of one hand and one end of the copper wire between the thumb and first finger of your other hand. The length of both the graphite and the copper wire should be about the same length. Dip about one centimeter of the wire and graphite into the water carefully. Have another student time how long it takes to feel the heat of the water in the fingertips of the graphite hand and in the fingertips of the copper wire hand. Record the time and your conclusion.

	COPPER	**GRAPHITE**
SHINY/DULL		
COLOR		
CONDUCTABILITY		
DUCTILITY		
MALLEABLITY		
USES OF:		

APPENDIX H-It's Still All About Matter

Name_____Date_____

SCIENCE DISCOVERY SHEET

Activity Name_____

Purpose (or Hypothesis)_____

_____

_____

Materials:

1.

2.

3.

4.

5.

Procedure:

1.

2.

3.

4.

5.

6.

7.

8.

Outcome or Conclusion:_____

_____

_____

APPENDIX I-It's Still All About Matter

Name_____Date_____

COMPOUNDS

1. Name the elements that make up the following compounds:

a. H_2SO_2_____

b. CO_2_____

c. H_2O_2_____

d. $CuSO_4$_____

e. $C_{12}H_{22}O_{11}$_____

f. $C_6H_8O_6$_____

2. Determine the elements that make up these compounds. Then, use the names of the elements to figure out the name of the compound. Place the number of the name of the compound in the blank.

_____	a.	O_2	1. copper sulfate
_____	b.	Fe_2O_3	2. chlorine gas
_____	c.	$CuSO_4$	3. iron oxide
_____	d.	Al_2O_3	4. aluminum oxide
_____	e.	Cl_2	5. oxygen gas

APPENDIX J-It's Still All About Matter

Key for Appendix I

Name_____Date_____

COMPOUNDS

1. Name the elements that make up the following compounds:

a. H_2SO_4_____HYDROGEN, SULFER, OXYGEN

b. CO_2_____CARBON, OXYGEN

c. H_2O_2_____HYDROGEN, OXYGEN

d. $CuSO_4$_____COPPER, SULPHUR, OXYGEN

e. $C_{12}H_{22}O_{11}$_____CARBON, HYDROGEN, OXYGEN

f. $C_6H_8O_6$_____ CARBON, HYDROGEN, OXYGEN

2. Determine the elements that make up these compounds. Then, use the names of the elements to figure out the name of the compound. Place the number of the name of the compound in the blank.

__5__ a.	O_2	1. copper sulfate
__3__ b.	Fe_2O_3	2. chlorine gas
__1__ c.	$CuSO_4$	3. ammonia
__4__ d.	$A_{l2}O_3$	4. aluminum oxide
__2___ e.	Cl_2	5. oxygen gas