Understanding and Measuring Matter

Grade Level: Grade 1
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Length of Unit: Seven Lessons

I. ABSTRACT

This is an eight class period unit designed to provide the student experience with the concepts concerning matter and measurement of matter contained in the first grade section of the *Core Knowledge Sequence*. Throughout the course of this unit, students will become aware that their world is made up of matter in three forms, and that matter is made up of atoms. Through participating, predicting, and observing during various hand-on activities, the will become able to recognize and measure the three states of matter.

By observing ice melting and evaporating, they will see water in each state of matter. Students will apply their knowledge by measuring, defining, and identifying the three states of matter, and also through creating "Matter Books." Assessments will include the unit-long, student created book, an oral quiz, classroom matter and vocabulary charts, measurement worksheets, and teacher observation.

II. OVERVIEW

A. Concept Objectives
   1. Students will recognize and understand that the world is made of matter. (Colorado State Standard-Science #2)
   2. Students will develop an awareness of the characteristics of matter. (CSS #2)

B. Content from the *Core Knowledge Sequence*
   1. Science: Matter and Properties of Matter: Measurement

C. Skill Objectives
   1. The students will define matter.
   2. The students will help represent the abstract concept of atoms in a concrete way.
   3. The students will identify and define solids both in the classroom and from pictures.
   4. The students will categorize and list solids.
   5. The students will measure solid objects in inches, centimeters, feet, and pounds.
   6. The students will identify solids.
   7. The students will identify liquids.
   8. The students will estimate and measure liquids.
   9. The students will recognize that gas occupies space.
   10. The students will observe various gases.
   11. The students will follow oral directions.
   12. The students will orally share what they know about matter.
   13. The students will predict outcomes.
   14. The students will understand cause and effect relationships.
   15. The students will observe and measure temperature using a thermometer.
   16. The students will be able to recognize and name the three states of matter.

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. Cooper, Christopher, *Matter*
   2. Darling, David, *From Glasses to Gasses*
   3. Glover, David, *Solids and Liquids*
   4. Matter is made up of small, invisible particles called atoms.

5. Matter exists in three forms: solids, liquids, and gases.
    a. A solid is a form of matter that has its own shape.
    b. A liquid is a form of matter that takes the shape of its container.
    c. A gas is a form of matter that you cannot see, which will occupy the available space.
6. Matter can change from one form to another, such as ice (solid) melting to water (liquid) and then changing to steam (gas).
7. The length and width of solid matter can be measured using Standard and Metric measurements such as inches, feet, and centimeters.
8. The volume of liquid matter can be measured using Standard units such as cups, quarts, and gallons.
9. The weight of matter can be measured using a scale.
10. The temperature of matter can be measured using a thermometer.

B. For Students
1. This is the student's first exposure to matter in the *Core Knowledge Sequence*.
2. Some of the math concepts of measurement for first grade are included in the unit. The students have been exposed to instruments of measurement in Kindergarten such as a ruler, scale, and thermometer. They also have begun to measure in inches. They have learned to compare objects according to linear measure, weight, capacity, and temperature.

IV. RESOURCES

A. Darling, David, *From Glasses to Gases*
B. Glover, David, *Solids and Liquids*
C. Nevins, Daniel, *What Happens If…?*

V. LESSONS

Lesson One: What Is Matter?

A. *Daily Objectives*
1. Concept Objective
    a. Students will recognize and understand that the world is made of matter.
2. Lesson Content
    a. Matter is anything that takes up space and has weight.
    b. Matter is made up of atoms.
3. Skill Objectives
    a. The students will define matter.
    b. The students will help represent the abstract concept of atoms in a concrete way.

B. *Materials*
1. Appendix A
2. *From Glasses to Gases* by David Darling
3. Vocabulary Chart
4. *What Happens If?* By Daniel Nevins
5. Sugar in sandwich bags
6. Toothpicks
7. Cups of water
8. String
9. Appendix B

C. *Key Vocabulary*
1. Matter: anything that takes up space and has weight
2. Atoms: small, invisible particles that make up matter

D. *Procedures/Activities*
   1. Matter is anything that takes up space and has weight. It is made up of small, invisible particles called atoms. This is a new concept for first graders and this abstract idea will be taught in a concrete way during this lesson.
   2. Read the matter poem, "Matter Really Matters." (See Appendix A)
   3. Read pages 11-12 "Three States of Matter" from *From Glasses to Gases*.
   4. On a large sheet of chart paper, start a vocabulary chart on which you will write the key vocabulary words throughout the unit. Title your chart "Matter Vocabulary." Write your first vocabulary word, "Matter" and have the students define.
   5. Do the following experiment form page 16 in *What Happens If?* Give students a small cup of water and have them taste the water. Give students a bag of sugar and have them observe the small particles of sugar. Put sugar in the water and stir with toothpicks to dissolve the sugar. Have students taste the water. Discuss that they can taste the sugar in the water, but cannot see it. Compare this to atoms in matter. Say, "We cannot see, taste, or smell atoms, but we know they are there."
   6. Write and define "Atoms" on the vocabulary chart.
   7. With string, tie students closely together. Tell them they are now the atoms making up one form of matter, which is solid. Loosen the string. Tell them they are still atoms but now making up another form of matter, which is liquid. Let go of the string and tell them to spread out in the room. Tell them they are still atoms, only now in the last form of matter, which is gas.
   8. Teach the students verse one of the Matter Song, which is "Solids, Liquids, Gases." (See Appendix B)
   9. Send home Appendix C and ask students to share this new information with their parents.

E. *Evaluation/Assessment*
   1. Evaluate student responses when writing vocabulary definitions.

Lesson Two: Solids

A. *Daily Objectives*
   1. Concept Objective
      a. Students will develop an awareness of the characteristics of matter.
   2. Lesson Content
      a. A solid is a state of matter.
   3. Skill Objectives
      a. The students will identify and define solids both in the classroom and from pictures.
      b. The students will categorize and list solids.

B. *Materials*
   1. *Solids and Liquids* by David Glover
   2. A variety of solids- metal, rubber, glass, wood, woven fibers, and plastic
   3. Classroom chart of matter (See Appendix D)
   4. Appendix E

C. *Key Vocabulary*
   1. Solid: a form of matter that has its own shape

D. *Procedures/Activities*
   1. In advance, prepare a large chart of Appendix D that will be used throughout the unit.
   2. Read the definition of "solids" from page 4 of *Solids and Liquids*, and write the definition on the vocabulary chart.
   3. Refer to the string activity from Lesson One when students were atoms in a solid to remind them of the characteristics of a solid.

4. Play "Eye-Spy" game from *Solids and Liquids* pg. 4. Pull solid objects from a tub. Have students identify objects and materials from which they are made. Find additional objects in the classroom that are made from these materials.
5. Complete the "Solid" column from the classroom chart of matter. (See Appendix D) Ask the question in the Matter column and write "Yes" or "No" in the Solid column.
6. Read matter poem together. (See Appendix A)
7. Homework is Appendix E.

E. *Evaluation/Assessment*
1. Observe and evaluate student responses during "Eye-Spy" game.
2. Assess students' understanding of solids from Appendix E homework lists.

Lesson Three: Measuring Solids

A. *Daily Objectives*
1. Concept Objective
   a. Students will develop an awareness of the characteristics of matter.
2. Lesson Content
   a. A solid is a state of matter
   b. Units of measurement
3. Skill Objectives
   a. The students will measure solid objects in inches, centimeters, feet and pounds. (CSS- Science #1, CSS- Math #4 and #5)
   b. The students will identify solids.

B. *Materials*
1. Appendix F
2. Rulers with inches and centimeters
3. Bathroom scales
4. Magazines- one for each child
5. Appendix G
6. Appendix H

C. *Key Vocabulary*
1. Inches: a standard unit of measurement for length
2. Feet: a standard unit of measurement for length
3. Centimeters: a metric unit of measurement for length
4. Pounds: a standard unit of measurement for weight

D. *Procedures/Activities*
1. In this lesson the students will begin a unit-long Matter Book. It will be bound, completed, and sent home at the end of the unit.
2. Measure desks, common reading books, and pencils together as a class in both inches, feet, and centimeters. (See Appendix F) Add "Inches," "Feet," and Centimeters" to room vocabulary chart.
3. Measure height of students. (See Appendix F)
4. Weigh a solid classroom object on the scale, telling the students that solids can also be measured by their weight. Then weigh students on a bathroom scale. Have the record their results. (See Appendix F) Add "Pounds" to classroom vocabulary chart.
5. Begin Matter Book. Have students cut pictures of solids form magazines and glue to Appendix G to create a solid collage. (adapted from Mailbox, 1999-2000, December/January, pg. 44)
6. Sing verses 1-2 of "Solids, Liquids, Gases." (See Appendix B)
7. Take home vocabulary sheet. (See Appendix H)

E. *Evaluation/Assessment*
1. Evaluate student measurements from Appendix F.

2. Evaluate student choices for the "Solid" page of the Matter Book.

Lesson Four: Liquids

A. *Daily Objectives*
   1. Concept Objective
      a. Students will develop an awareness of the characteristics of matter.
   2. Lesson Content
      a. A liquid is a state of matter.
   3. Skill Objectives
      a. The students will identify liquids.
      b. The students will estimate and measure liquids. (CSS- Math #5.1 and #5.3)

B. *Materials*
   1. *Solids and Liquids* by David Glover
   2. Water
   3. Containers in a variety of shapes and sizes
   4. Cup, quart, and gallon containers
   5. Classroom Matter Chart
   6. Classroom vocabulary chart
   7. Appendix I
   8. Watercolors
   9. Cups of water for watercolors
   10. Appendix K
   11. Kool-Aid

C. *Key Vocabulary*
   1. Liquid: a form of matter that takes the shape of its container
   2. Cups: a standard unit of measurement for liquids
   3. Quarts: a standard unit of measurement for liquids
   4. Gallons: a standard unit of measurement for liquids

D. *Procedures/Activities*
   1. Read "What's It Made Of?" from page 4 in *Solids and Liquids*. Write the definition of "Liquids" on the vocabulary chart.
   2. Refer to the string activity from Lesson One when students were atoms in liquid to remind them of the characteristics of liquid.
   3. Brainstorm a list of liquids on the chalkboard to refer to during this lesson.
   4. Complete the "Liquid" column of the Matter Chart.
   5. Pour water into a variety of containers, discussing how liquids take on the form of the containers.
   6. Record student estimations on the board and measure water using cups, quarts, and gallons.
   7. Make the "Liquid" booklet page while drinking Kool-Aid. Using watercolors let students paint their favorite flavor of Kool-Aid in their glass. (See Appendix I) Sing verses 1, 2 and 3 of "Solids, Liquids, and Gases." (See Appendix B)
   8. Give students vocabulary words to share with their parents. (See Appendix J)

E. *Evaluation/Assessment*
   1. Evaluate responses while creating the classroom list of liquids.
   2. Check for reasonable estimations and correct measurements.

Lesson Five: Gas

A. *Daily Objectives*
   1. Concept Objective
      a. Students will develop an awareness of the characteristics of matter.

2. Lesson Content
    a. Gas is a state of matter.
    b. Identifying different examples of gasses.
3. Skill Objectives
    a. The students will identify that gas occupies space.
    b. The students will observe various gases.

B. *Materials*
1. *Solids and Liquids* by David Glover
2. Plastic sandwich bags
3. Vocabulary chart
4. Clear bowl (4 inches high and 6 inches wide) with water
5. Ruler
6. Paper towel
7. 3-ounce paper cup
8. Helium balloons
9. Regular balloons
10. Matter Chart
11. Appendix K

C. *Key Vocabulary*
1. Gas: a form of matter that you cannot see
2. Oxygen: a type of gas
3. Helium: a type of gas

D. *Procedures/Activities*
1. Read the top of page 5 in *Solids and Liquids*. Write the definition of "Gas" on the vocabulary chart.
2. Refer to the string activity form Lesson One when students were atoms in gas to remind them of the characteristics of gases.
3. Do a "Spacey" experiment (*Play and Find Out*, pgs. 7-8). Fill your clear bowl with about 3 inches of water. Crumple your paper towel into a ball and push it into the inside bottom of your cup. Turn the cup upside down making certain that the towel is remaining at the bottom of the cup. Hold the cup upside down and put it straight down into the bowl of water until it touches the bottom, making sure that the cup is not tilting. Lift the cup out without tilting, and remove the crumpled towel from the cup. The towel should have remained dry. The air filled all of the empty space in the paper cup, keeping the water out when you put it into the bowl. Discuss that gases fill their containers, which is why the towel remained dry.
4. Pass out plastic bags. (*Play and Find Out*, pg. 9) Have students move bags through the air and catch air. Let them squeeze and change the shape of the bags. Tell the students that just like this experiment, air, which is a gas, is easy to catch, because it is all around us.
5. Compare a helium and a regular balloon. Both are filled with gas, yet one stays in the air, while the other falls. Tell students that like solids and liquids there are also different types of gases. Add "Helium" and "Oxygen" to the Vocabulary Chart.
6. Complete the "Gas" column of the Matter Chart together.
7. Pass out Appendix K for students to take home and share with parents.

E. *Evaluation/Assessment*
1. Evaluate student responses while completing Matter Chart.

Lesson Six: Reviewing Gases and Oral Evaluation

A. *Daily Objectives*
1. Concept Objective

a. Students will develop an awareness of the characteristics of matter.

2. Lesson Content
   a. Review matter
   b. Give individual oral assessments
3. Skill Objectives
   a. The students will follow oral directions.
   b. The students will orally share what they understand about matter.

B. *Materials*
1. Appendix L
2. Cotton balls
3. Blue construction paper
4. Appendix M
5. Appendix N
6. Two balloons for each student

C. *Key Vocabulary*
None

D. *Procedures/Activities*
1. Sing the Matter Song. (See Appendix B)
2. Have and aide or a parent volunteer lead students in making the "Gas" page of their Matter Book. (See Appendix L) Students will color in the hot air balloon, the cut out the balloon and glue onto a piece of blue construction paper. Let them use cotton balls to create clouds, and write the word "gas" on the page.
3. While students are working on their Matter Books, call them back one at a time to take an oral quiz. (See Appendix M)
4. For an extra review of gas, send home Appendix N and two balloons with the students.

E. *Evaluation/Assessment*
1. Use rubric while administering the oral quiz to assess student understanding of matter.

Lesson Seven: Water as an Example of Changing States of Matter

A. *Daily Objectives*
1. Concept Objectives
   a. Students will recognize and understand that the world is made of matter.
   b. Students will develop an awareness of the characteristics of matter.
2. Lesson Content
   a. Water can change into the three states of matter.
   b. The three states of matter can exist together.
3. Skill Objectives
   a. The students will predict outcomes.
   b. The students will understand cause and effect relationships.
   c. The students will observe and measure temperature using a thermometer. (CSS-Math #5.1)
   d. The students will be able to recognize and name the three state of matter.

B. *Materials*
1. Appendix O
2. Ice cubes
3. Electric frying pan
4. Thermometer
5. Student Matter Book pages
6. Sheet of construction paper for each student

C. *Key Vocabulary*
None

D. *Procedures/Activities*
   1. Put ice cubes in a bowl and measure their temperature with a thermometer. Have students write predictions on Appendix O. Add "Thermometer" to the vocabulary chart. Put ice cubes in electric frying pan and melt the ice. Measure and record results on Appendix O and then make more predictions. Heat until water boils. Measure and record results on Appendix O. Discuss the three states of matter that were seen, the results from the experiment, and their predictions.
   2. Using your results from the oral quiz in Lesson Six, review with the students the states of matter.
   3. Pass out pages of the student Matter Books. (Remember that the books are not yet bound.) Play a game where the students must hold up the correct page form their books when you call out a specific example of matter. For example: Icicles-solid, steam- gas, water- liquid.
   4. Have students copy from the board the word "Matter" onto a piece of construction paper. Let them design and color their cover pages. Collect and staple.
   5. Sing the Matter Song. (See Appendix B)
   6. Send home completed Matter Books, which students may share with their parents.

E. *Evaluation/Assessment*
   1. Collect and evaluate student predictions looking for reasonable responses on Appendix O.
   2. Assess student responses during the game.

VI. CULMINATING ACTIVITY- Sparkle Jars (adapted from *Science Art*, pg. 141)

A. As an end to the unit help the students make their own Sparkle Jars. The Sparkle Jar includes all three states of matter. The students should be able to differentiate each state and also recognize that they can all exist in one space.

B. You will need the following supplies:
   1. tall narrow jars with lids (jam jars, Tabasco jars, plastic soda bottles)
   2. glitter, small plastic sequins, crayons shavings, seeds, beads
   3. water
   4. light corn syrup
   5. paper funnel

C. Have Solid and Liquid Centers set up for students to go to for the various materials needed for their jars. At Liquid Center fill bottles with one third corn syrup and two thirds water. At the solid center add sequins, glitter, etc. using a paper funnel to add solids. After all students are done ask them to observe their jars, first without shaking, and identify liquids, solids, and gas (an air bubble that rises). Then, let children shake and observer the matter in their jars.

VII. HANDOUTS/WORKSHEETS

A. Appendix A: Poem- "Matter Really Matters"
B. Appendix B: Song- "Solids, Liquids, and Gases"
C. Appendix C: Homework- Today's Vocabulary: Matter and Atoms
D. Appendix D: Matter Chart
E. Appendix E: Homework- List of Solids
F. Appendix F: Worksheet- Measurement of Solids
G. Appendix G: Matter Book- Solids: Solid Collage
H. Appendix H: Homework- Today's Vocabulary: Solid, Inches, Feet Centimeters, and Pounds
I. Appendix I: Matter Book- Liquid: Glass to Paint
J. Appendix J: Homework- Today's Vocabulary: Liquid, Cups, Quarts, and Gallons
K. Appendix K: Homework: Today's Vocabulary: Gas, Oxygen, and Helium
L. Appendix L: Matter Book- Gas: Hot Air Balloon
M. Appendix M: Oral Quiz Rubric
N. Appendix N: Homework- Balloon Experiments
O. Appendix O: Worksheet- Wonderful Water: Measurement/Predictions of Changing States of Water

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Matter Really Matters

By Sue Boulais

Matter is very important;
It makes up the things that we see.
Without it, all things as we know them
Would simply just not be!

We wouldn't have fish in the ocean;
We wouldn't have clouds in the air.
No people in houses, no grass on the ground.
Why, the ground wouldn't even be there!

Matter is very important-
Especially to you and to me.
Everyone's made up of matter…
Without it, we just wouldn't be!

(This could be used as a bulletin board through this unit,
so you may refer the students to it easily to read together.)

Appendix B-Understanding and Measuring Matter

Solid, Liquids, and Gases

Written Judy Beaty
Adapted by Kathleen Edwards and Betsy Watwood
(sung to the tune of Brother John)

1. Solids, Liquids, Gases
Solids, Liquids, Gases
Make up matter.
Make up matter.
Everything is made of atoms.
Everything is made of atoms.
This we've learned.
This we've learned.

2. Solids have weight.
Solids have weight.
They have their own shape.
They have their own shape.
They can be measured.
They can be measured.
This we've learned.
This we've learned.

3. Liquids have weight.
Liquids have weight.
They take the shape
They take the shape
Of their containers
Of their containers
This we've learned.
This we've learned.

4. Gases have weight.
Gases have weight.
They occupy space.
They occupy space.
We cannot see them.
We cannot see them.
This we've learned.
This we've learned.

Today's Vocabulary

Matter: anything that takes up space and has weight.

Atoms: small, invisible particles that make up matter.

Dear Parents,

These are some new words that we learned in class today in our unit on Matter. Please discuss them with your child tonight.

Sincerely,

Appendix D-Understanding and Measuring Matter

Matter	Solid	Liquid	Gas
Does it take up space?	Yes	Yes	Yes
Does it have weight?	Yes	Yes	Yes
Is it visible?	Yes	Yes	No
Can it change shape easily?	No	Yes	Yes

(In this unit, fill in the answers as a class on a wall chart.)

Appendix E-Understanding and Measuring Matter

Name_____

Make a list of the solids that you see in your bedroom.

_____

_____

_____

_____

_____

_____

_____

_____

_____

How many solids did you find? _____

Appendix F-Understanding and Measuring Matter

Name_____

Measurement

Measure the following items:

Your pencil

_____inches _____centimeters

The top of your desk

Length

_____inches _____centimeters

Width

_____inches _____centimeters

Your reading book

Length

_____inches _____centimeters

Width

_____inches _____centimeters

Your height

_____feet _____inches

Your weight

_____pounds

Appendix G-Understanding and Measuring Matter

Solids

Today's Vocabulary

Solid: A form of matter that has its own shape.

Inches: A standard unit of measurement for length.

Feet: A standard unit of measurement for length.

Centimeters: A metric unit of measurement for length.

Pounds: A standard unit of measurement for weight.

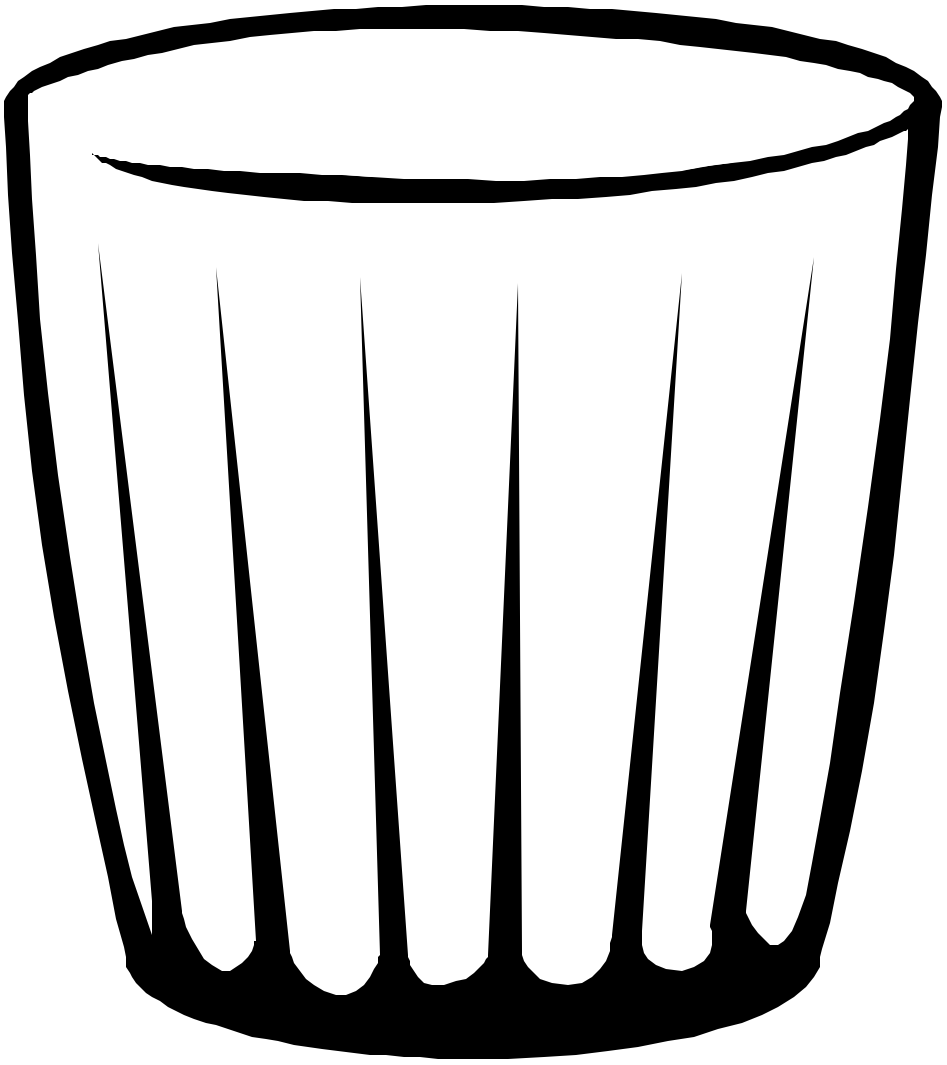
Dear Parents,

Here are some more new words that we learned in class today in our unit on Matter. Please discuss them with your child tonight. You may want to practice using the different measurements at home.

Sincerely,

Appendix I-Understanding and Measuring Matter

Liquid



Today's Vocabulary

Liquid: A form of matter that takes the shape of its container.

Cups: A standard unit of measurement for liquids.

Quarts: A standard unit of measurement for liquids.

Gallons: A standard unit of measurement for liquids.

Dear Parents,

In class today we discussed and measured liquids. Please discuss these words with your child tonight and practice measuring liquids.

Sincerely,

Today's Vocabulary

Gas: A form of matter that you cannot see, which will occupy the available space.

Oxygen: A type of gas.

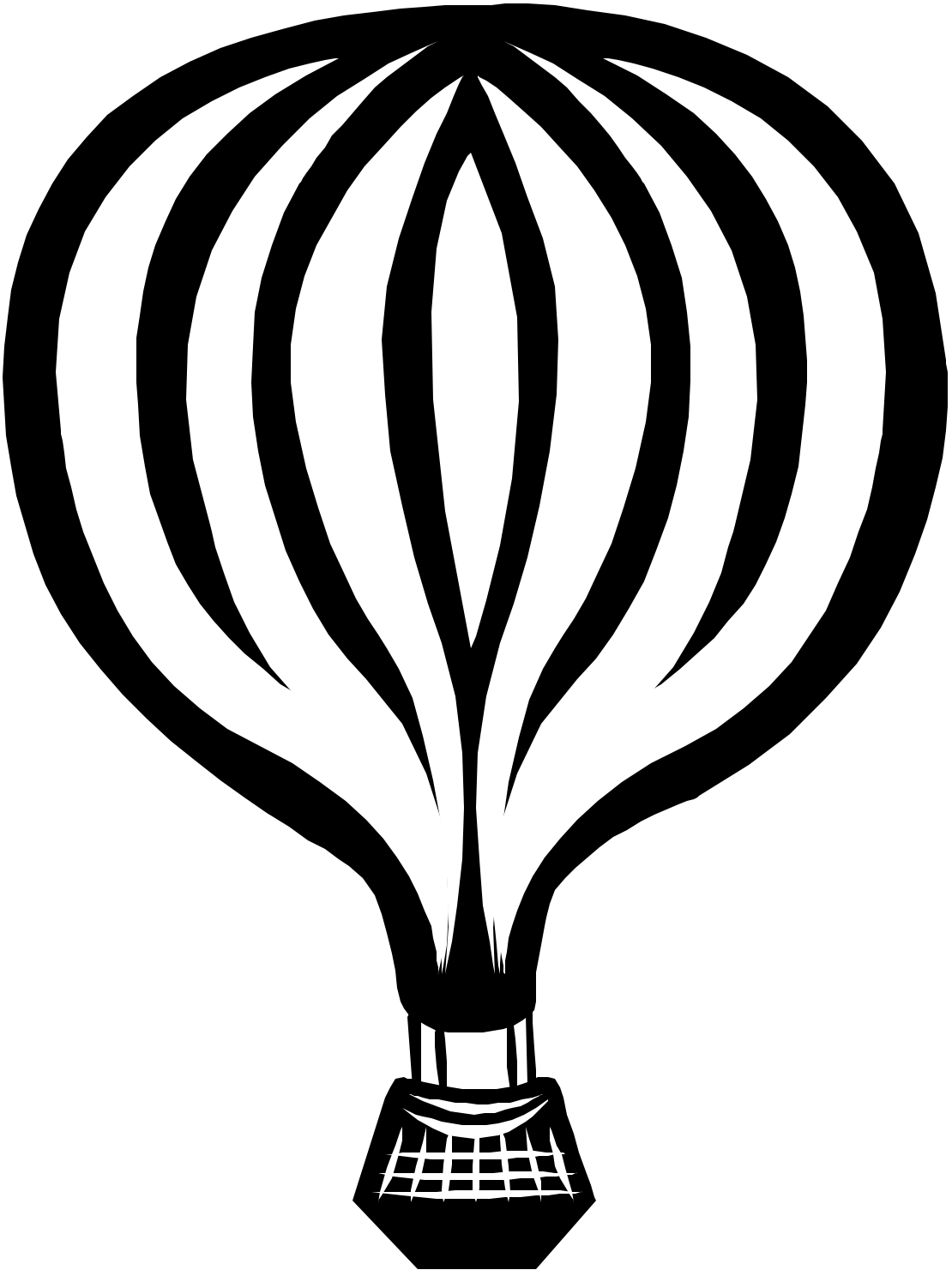
Helium: A type of gas.

Dear Parents,

In class today we discussed and did experiments with gases. Please discuss these words with your child tonight and ask them to tell you about gas.

Sincerely,

Appendix L-Understanding and Measuring Matter



Appendix M-Understanding and Measuring Matter

Oral Quiz Rubric

Name_____

Question	Yes	No	Points
Name the 3 states of matter?			**3** Liquid, Solid, Gas
What is matter made of?			**1** Atoms
Give me two examples of a solid.			**2** Wood, plastic, etc…
Give me two examples of a liquid.			**2** Water, Kool-Aid, etc…
Give me two examples of a gas.			**2** Air, helium, oxygen, etc…
What can you use to measure liquid?			**1** Cups, quarts, gallons, etc…
What can you use to measure solids?			**1** Inches, feet, pounds, centimeters
Which form of matter has a definite shape?			**1** Solid
Which forms of matter takes the shape of the container it is in?			**2** Liquid, Gas
Total			**/15**

Appendix N-Understanding and Measuring Matter

Here are some balloon experiments that you can do at home with your parents!

1. Blow up a balloon as big as you can. Do not tie it, but just hold it as tightly as you can. Hold it straight up in the air. Now let go and watch it fly away! Air shoots out one way, and the balloon moves the other way. When there is no more air left in your balloon, it will fall.

2. Blow up your balloon again. Hold it tight at the bottom. This time hold it sideways. Let it go, and watch which way it shoots. Did you notice anything different this time? It flies like a jet plane. As gas shoots out in back, the plane moves forward.

3. Blow up a balloon again and float it in the water of your bathtub. Let out the air and watch it shoot away. You have made a jet boat! Like a plane, as the gas shoots out in the back, the boat moves forward.

4. Blow up two balloons and ask a friend to have a balloon boat race with you in the bathtub.

5. Blow up a balloon and hold the neck under water. Let the balloon go. Did the air come out? Did the boat go?

Name _____

Wonderful Water!

Solids

Record the temperature of ice:_____

Predict what will happen to the ice when we raise the temperature.

Liquids

Record the temperature of the water:

_____

Predict what will happen to the water when we raise the temperature to boiling.

Gas

Record the temperature of the water when it is boiling:_____

Predict what will happen to the gas when we turn the heat off.

Predict what will happen when we put water in the freezer.

Draw pictures of the 3 states of matter that water was in our experiments.
