

## **MATTER: ITS STATES AND PROPERTIES**

Grade Level: First Grade

Presented by: Danielle Abrahamson and Susan Michalek, Academy of Charter Schools,  
Denver, Colorado

Length of Unit: Four lessons over a period of five to seven days

### **I. ABSTRACT**

- A. This unit focuses on kinesthetic experiences involving matter. Students will participate in varied activities while learning to identify solids, liquids, gases, and some of their properties. The learner will understand and use measuring tools to measure volume, mass, height, and temperature. This unit could be done in one self-contained classroom or as a team effort between grade level teachers. We would recommend collecting and preparing materials several days in advance. Whenever possible recruit parent volunteers or paraprofessionals to assist with implementing each of the learning stations.

### **II. OVERVIEW**

#### **A. Concept Objectives**

1. The learner will understand that there are many structures in the natural world that have chemical and physical properties.
2. The learner will understand that everything is made from matter.
3. The learner will understand that all things can be measured in a variety of ways.

#### **B. Content**

1. Names and common examples of three states of matter: solid (for example, wood, rocks), liquid (for example, water), gas (for example, air, steam).
2. Water as an example of changing states of matter of a single substance.
3. Units of measurement:
  - a. Length: centimeter, inch, foot
  - b. Volume: cup, quart, gallon
  - c. Temperature: degrees Fahrenheit

#### **C. Specific skills addressed in this unit are:**

1. Students will observe given objects and their properties of weight, space, and shape.
2. Students will categorize solids, liquids, and gases.
3. Students will identify the definitions of the three forms of matter: solid, liquid, and gas.
4. Students will measure liquids in cups, quarts, and gallon units.
5. Students will predict possible outcomes of experiments dealing with liquids, solids, and gases.
6. Students will observe a liquid changing into a solid over a period of several days.
7. Students will understand and discuss cause and effect relationships.
8. The learner will discover that gas takes up space.
9. The learner will follow oral directions.
10. Students will measure their height in centimeters, feet, and inches.
11. Students will measure weight in pounds

### **III. BACKGROUND KNOWLEDGE**

- A. This is the students' first exposure to the subject of matter. This topic is not introduced in the Kindergarten level. The following information is for the teacher's background information.

1. Matter is everything that takes up space, and has mass. All things in the universe are made of matter. The three forms of matter are: solids, liquids, and gases. A solid is anything that has its own shape. A liquid flows and will take the shape of the container it is in. A gas, though not visible, will spread out and fill available space.
2. Matter can change from one form to another. An example would be, ice, which is a solid; melts and becomes water, which is a liquid; and when boiling (212 degrees) becomes steam, a gas.
3. Matter can be measured in terms of mass, volume, length, and temperature. Mass can be measured in standard units. The most commonly used units are: ounces, and pounds, or grams, and kilograms. Volume is the term used for liquid measurement. Standard units for volume include: fluid ounces, cups, pints, quarts, gallons or milliliters and liters.

#### IV. **RESOURCES**

- A. Berger, Melvin. Solids, Liquids and Gases. G.P. Putnam's Sons, NY: 1989. ISBN # 0-399-21731-2.
- B. Cohen, Laura. Discovering Science: Matter. Torrance, CA: Frank Schaffer Publications, Inc. 1991. Cat # FS-2503
- C. DeWeese, Bob and Spero, Daniel J., Science Series: Matter and Energy, Monterey, CA: Evan-Moor, 1995. ISBN # 1-55799-521-4
- D. Friedhoffer, Robert. Matter and Energy. Franklin Watts, NY: 1992. ISBN # 0-531-11051-6.
- E. Hirsch, E.D., Jr. "Matter: Solid, Liquid, and Gas" What Your First Grader Needs to Know. NY: Doubleday, 1998. ISBN # 0-385-31987-8
- F. Osburne, Louise and Gold, Carol. Starting With Science: Solids, Liquids, and Gases. Buffalo, NY: Kids Can Press Ltd., 1998.

#### V. **LESSONS**

Lesson 1: What is Matter?

- A. Daily Objectives
  1. Lesson Content
    - a. Matter is anything that takes up space and has weight
    - b. Matter has different forms: solid, liquid, gas
  2. Concept Objectives
    - a. The learner will understand that there are many structures in the natural world that have chemical and physical properties.
    - b. The learner will understand that everything is made from matter.
    - c. The learner will understand that all things can be measured in a variety of ways.
  3. Skill Objectives
    - a. Students will observe given objects and their properties of weight, space and shape to determine their form: solid, liquid, gas.
    - b. Students will identify means of three forms of matter.
- B. Materials
  1. Assorted objects
  2. Ice cubes
  3. Hot plate (burner)
  4. Saucepan

5. Thermometer
  6. Appendix A & B
  - C. Background Notes (Please see Background Knowledge Section)
  - D. Key Vocabulary
    1. matter: any substance that takes up space and has weight
    2. solid: a form of matter with its own shape
    3. liquid: a free flowing form of matter that takes the shape of its own container.
    4. gas: molecules that move randomly in space and are loosely connected to one another, such as oxygen
  - E. Procedures/Activities
    1. Show the class a collection of assorted objects and ask, "How are all of these things alike?" (You could list students' responses on the board or chart paper if desired).
    2. Guide the discussion to conclusion that all of these things are made up of matter.
    3. Go over the definition of matter with the students. (Matter is anything that takes up space and has weight.)
    4. Have the students list things that are matter, guiding them to the conclusion that everything is made up of matter.
    5. Tell the students that we know what and we are going to find out what forms it comes in.
    6. Tell students there are three different types of matter: solids, liquids, and gases and give an example of each.(rock, milk, air)
    7. Show students an ice cube and ask, "What form of matter is this ice cube? Is it a solid, liquid or a gas?"
    8. Tell the students we are going to change this to a different form. Put the ice cube in a saucepan on low heat, and melt it. Ask students, "What form of matter is this now?"
    9. Ask, "What do you think will happen to this liquid if we turn up the heat? (Allow responses). Turn up the heat and observe what happens. What form of matter did it change to? Discuss.
  - F. Evaluation/Assessment
    1. Hand out worksheet (Appendix A & B). Go over the first three items together. Have the students cut and paste each item under the appropriate heading - solid, liquid or gas. Have the students complete the last six items alone. Read over the remainder or review choosing answers from the word box to fill in the blanks.
  - G. Standardized Test Connections
    1. The students listen attentively and engage actively in a variety of oral language experiences.
    2. The students will predict and hypothesize
  - H. Extension Activities
    1. Math - Measurement and recording: Have students use Appendix C. Have the learner measure the temperature of the ice cube. Record the temperature. Measure the temperature of the water when the ice cube has completely melted and record. Measure again at the boiling point and record.
- Lesson 2: Liquid to Solid - Rock Candy
- A. Daily Objectives
    1. Lesson Content
      - a. liquid to solid

2. Concept Objectives
    - a. The learner will understand that there are many structures in the natural world that have chemical and physical properties.
  3. Skill Objectives
    - a. Students will measure liquids and solids in cup units.
    - b. Students will predict possible outcomes in experiment dealing with liquids and solids.
    - c. Students will observe a liquid changing to a solid over a period of days.
- B. Materials
1. small saucepan
  2. hot plate (burner)
  3. one cup water
  4. 1 and 1/2 cups sugar
  5. wooden spoon
  6. large glass
  7. pencil
  8. clean cotton string (12 inches)
- C. Background Notes (please see Background Knowledge Section)
- D. Key Vocabulary
1. dissolve: to make solution by mixing a substance into a liquid
- E. Procedures/Activities
1. Do a brief review of what matter is and the three forms that matter takes.
  2. Questions to ask:
    - a. What do we call anything that takes up space and has weight?(matter)
    - b. What is a form matter that has its own shape?(solid)
    - c. What type of matter spreads out to fill available spaces?(gas)
    - d. This type of matter takes the shape of the container it is in. (liquid)
  3. At this point you may want to discuss that a gas also takes the shape of its container.
  4. Tell students, "Today we will prepare an experiment in which we will observe over several days, a liquid changing into a solid."
  5. Have a student measure one cup of water into a saucepan.
  6. Teacher will boil the water.
  7. Have another student measure 1 and 1/2 cups of sugar and add GRADUALLY to boiling water while another student stirs. Stir until all sugar is dissolved.
  8. Allow the sugar water to cool and have another student pour it into a glass.
  9. Call on another student to tie one end of the string around the pencil.
  10. Have a student rub some grains of sugar into the string and drop the free end into the solution resting the pencil across the top of the glass.
  11. Find a safe place to store where it can be observed over several days.
  12. Each day (for 2-4 days) check on this and make observations as a class.
- F. Evaluation/Assessment
1. Open discussion - What are some other examples of a liquid changing to a solid? (water to ice, rain to snow, cement, lava, plaster of Paris)
- G. Extension Activities
1. Home activity: Encourage students to try this at home with supervision (see Appendix D).
- H. Standardized Test Connections

1. Students exposed to cup measurements.
2. Students will predict possible outcomes.

Lesson 3: What is a Gas?

A. Daily Objectives

1. Lesson Content
  - a. Expand students understanding of what a gas is
2. Concept Objectives
  - a. The learner will understand that there are many structures in the natural world that have chemical and physical properties.
  - b. The learner will understand that everything is made from matter.
3. Skills Objectives
  - a. The student will predict outcomes.
  - b. The students will understand cause and effect relationships.
  - c. Students will understand that gases take up space.
  - d. Students will participate in classroom discussion.
  - e. Students will follow oral directions.

B. Materials (based on 30 student classroom)

1. Huff -N- puff Station
  - a. 30 2-litre plastic soda containers (empty and clean)
  - b. 30 six inch balloons
2. Paper in the Glass Trick Station
  - a. large clear glass bowl (non-colored glass)
  - b. 2 large, clear sturdy, plastic cups (drinking glass)
  - c. roll of paper towels
3. Only Your Nose Knows Station
  - a. a small bottle pure vanilla extract
4. Off to the Races Station
  - a. large clear glass
  - b. 2 two liter bottles of ginger ale or other clear soda
  - c. large can raisins (12-16 oz.)
  - d. spoon

C. Background Notes (please see Background Knowledge Section)

D. Key Vocabulary

1. expanding: when an object becomes larger
2. air pressure: the force that air places on anything it touches
3. condensation: the process by which gas changes into a liquid

E. Procedures/Activities

1. Tell students, "Today we will be working separate stations where you will have the opportunity to make discoveries about what a gas is." Give instructions at each station. Each station should have a teacher or an adult volunteer to give instructions and to guide students.
2. Divide students into four different groups and disperse one group to each station. For a 30-minute lesson you would allow 5-7 minutes per station.
3. Huff -N- Puff Station (Appendix E)
  - a. Prior to class time be sure outside wrappers are removed from 2-litre soda containers and push a deflated balloon into each bottle. Stretch the end of the balloon over the tip of the bottle opening.

- b. Hand out appendix E
  - c. Students will be told that they will be trying to blow the balloon up into the bottle. Before letting them try this ask them to look at the pictures on their paper and circle the one shows what they think will happen. The balloon will not expand because of the air that is already in the bottle and unable to move. The correct answer is that the balloon cannot be filled. Then allow students to try.
4. Paper in the Glass Trick (Appendix F)
- a. Hand out Appendix F.
  - b. Have a student wad one or two paper towels and place securely into the bottom of the glass so that it stays in place when held upside down.
  - c. Fill the glass bowl with water.
  - d. Explain to the students that we are going to turn the glass with the paper towel upside down and holding the glass very straight, push it quickly down the water. Ask the students to circle the picture that they think best represents what will happen. Next, insert the glass into the water. Have the group count to ten. Have the student lift the glass straight out of the water without tipping it to one side or the other. Have the student check to see if the paper towel is wet or dry. If done correctly there should be no water inside the glass and the paper towel will remain dry.
  - e. Briefly discuss with students what happened.
5. Only Your Nose Knows Station
- a. Hand out Appendix G.
  - b. Ask students, "Can you see a gas?" Allow responses.
  - c. Show students the bottle and ask them to predict what might happen after the lid is removed.
  - d. Remove the lid from the vanilla extract and smell what happens.
  - e. Discuss what happened when the lid was removed. Explain that gases travel through the air. Ask, "Who smelled it first?" Remind students how the gas traveled from the front of the group until it spread around the area so that all could smell it. This is because the gas traveled through the air. This would be a great opportunity to tell students that not all gases smell good or are safe for us to breathe in because they could be harmful to our bodies.
6. Off to the Races Station
- a. Hand out Appendix H.
  - b. Ask students, "Can you see a gas?"
  - c. Fill a large, clear glass with soda by tipping the glass to one side carefully pouring the soda down one side of the container. This will keep the soda from losing too much of its carbonation.
  - d. Explain to the students that you are going to have someone come up and put two raisins into the soda. Ask them to look at the pictures and predict what they think will happen to the raisins.
  - e. Drop the raisins into the soda and observe what happens.
  - f. Discuss what happened to the raisins. Ask why they think the raisins moved as they did, allow responses. Then explain that the raisins rise because the bubbles of carbon dioxide stick to the raisins. When enough bubbles have stuck to the raisins they actually lift the raisin to the

surface. As the bubbles pop at the surface the raisin will eventually fall to the bottom again.

F. Evaluation/Assessment

1. Here are some suggestions for how to use the Appendices (E, F, G, H) for assessment and evaluation:
  - a. Note if children have completed all responses and give a score on a basis of zero to ten points (zero - no effort to ten – high participation).
  - b. Give credit for hypothesizing even if incorrect as long as student shows scientific reasoning in an oral discussion.

G. Standardized Test Connections

1. Predicting outcomes
2. Examining and describing state of matter - gas

Lesson 4: Units of Measurement

A. Daily Objectives

1. Lesson Content
  - a. Liquid measurement - cups, quarts, gallon
  - b. Weight measurement – pounds
  - c. Height measurement - inches, centimeters
2. Concept Objectives
  - a. The learner will understand that all things can be measured in a variety of ways.
3. Skill Objectives
  - a. Students will measure their own height in centimeters and inches.
  - b. Students will measure liquid in cups, quarts, and one gallon.
  - c. Students will measure their own weight in pounds.

B. Materials

1. Appendix I
2. Station 1: Weight measurement
  - a. bathroom scale
3. Station two: Height measurement
  - a. growth chart with inches and centimeters
  - b. pencil
  - c. ruler for marking height
4. Station Three: Liquid measurement
  - a. 2 one cup measuring cups
  - b. 2 one quart milk jugs
  - c. 2 one gallon milk jugs
  - d. a large bucket filled with water

C. Background Notes (Please see Background Knowledge section)

D. Key Vocabulary

1. centimeter: metric unit of measurement equal to .394 inches. The metric system is basic on units of ten.

E. Procedures/Activities

1. Set up three different stations. Station one measures students' height in centimeters and feet and inches. Station two has students step onto a bathroom scale and record their weight in pounds. Station three is set up to have students measure liquid in cups, quarts and gallons.

2. Hand out Appendix I to the students. Demonstrate how to measure at each station. It might be helpful to have a parent volunteer to monitor each station.
  3. Station One: How tall am I?
    - a. Using the growth chart and a ruler have the adult place the ruler on top of the child's head to determine their height on the growth chart. Place a mark in pencil on the growth chart for each student.
    - b. The teacher will need to help the student calculate each child's height in feet and inches.
    - c. The teacher will again need to assist the student calculate each his/her height in centimeters.
    - d. Have the learner record their two measurements on Appendix I.
  4. Station Two: How much do I weigh?
    - a. Have the student step onto the scale to see how much they weigh in pounds. Have the student record their weight on Appendix I.
  5. Station three: Liquid measurement
    - a. Have students take a one cup measuring cup, fill it with water and empty the water into a one quart container. Continue to fill the quart container until full. Have them record how many cups it took to fill the one-quart container.
    - b. Have the student use a one-quart container to fill a one-gallon container. Record how many quarts it took to fill the gallon container.
- F. Evaluation/Assessment
1. Use Appendix I to evaluate participation, accuracy in liquid measurement.
- G. Standardized Test Connections
1. Students will use various units of measurement.

## VI. CULMINATING ACTIVITY

- A. This unit contains a variety of kinesthetic activities, therefore our culminating activity is in the form of a test. This test could also be given orally, individually for students with special needs. Please use Appendix J.

## VII. APPENDICES

- A. Appendix A: Matter
- B. Appendix B: Matter (cont.)
- C. Appendix C: States of Matter- Recording Temperature
- D. Appendix D: Home Experiment: Rock Candy
- E. Appendix E: Prediction Sheet: What is a Gas?
- F. Appendix F: Prediction Sheet: Paper in the Glass trick
- G. Appendix G: Prediction Sheet: Only Your Nose Knows
- H. Appendix H: Prediction Sheet: Off to the Races
- I. Appendix I : Units of Measurement
- J. Appendix J: Matter: Its States and Properties Test

## VIII. BIBLIOGRAPHY

- A. Berger, Melvin. Solids, Liquids and Gases. G.P. Putnam's Sons, NY: 1989. ISBN # 0-399-21731-2.
- B. Cohen, Laura. Discovering Science: Matter. Torrance, CA: Frank Schaffer Publications, Inc. 1991. Cat # FS-2503

- C. DeWeese, Bob and Spero, Daniel J., Science Series: Matter and Energy, Monterey, CA: Evan-Moor, 1995. ISBN # 1-55799-521-4
- D. Friedhoffer, Robert. Matter and Energy. Franklin Watts, NY: 1992. ISBN # 0-531-11051-6
- E. Hirsch, E.D., Jr. "Matter: Solid, Liquid, and Gas" What Your First Grader Needs to Know. NY: Doubleday, 1998. ISBN # 0-385-31987-8.
- F. Michalek, James. Illustrator for all appendices. 1999.
- G. Osburne, Louise and Gold, Carol. Starting With Science: Solids, Liquids, and Gases. Buffalo, NY: Kids Can Press Ltd., 1998.

MATTER - LESSON 1

Name \_\_\_\_\_

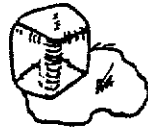


Matter is anything that has weight and takes up space. Matter comes in three different forms: solid, liquid and gas.



solid - has its own shape

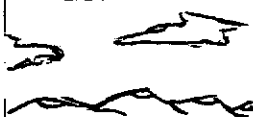

liquid - flows to the bottom of a container



gas - spreads out to fill available space

\*\*\*\*\* CUT AND PASTE \*\*\*\*\*

SOLID	LIQUID	GAS
ice cube 	water 	steam 

milk 
book 

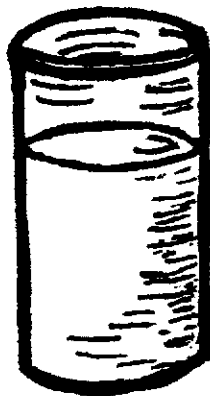
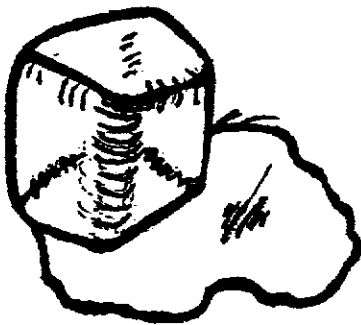
air 
helium balloon 

tree 
oil 

Use the words from the word box to answer the questions.

liquid	weight	space	gas	matter	solid
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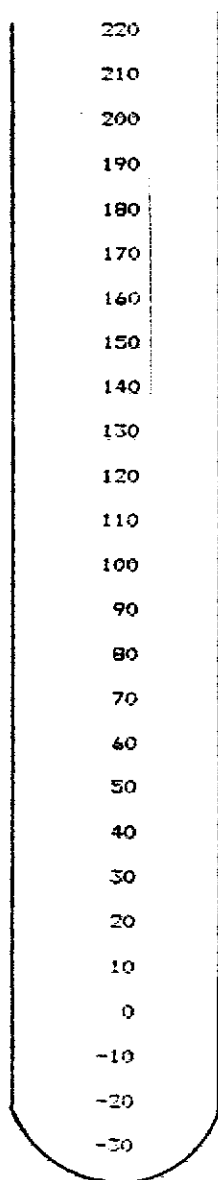
1. Everything is made up of \_\_\_\_\_ .
2. Matter has to have \_\_\_\_\_ and it must take up \_\_\_\_\_ .
3. \_\_\_\_\_ has its own shape.
4. \_\_\_\_\_ spreads out to fill available spaces.
5. \_\_\_\_\_ flows to the bottom of a container.



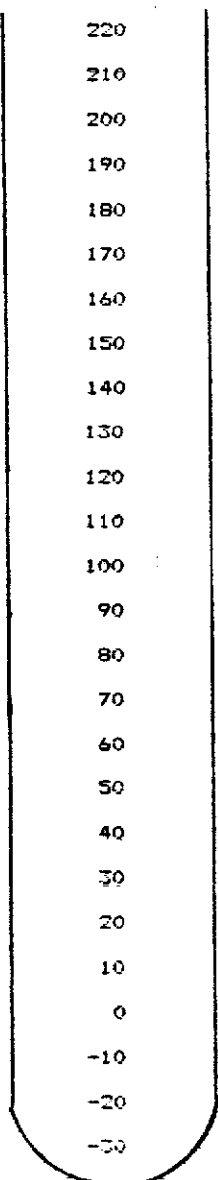
STATES OF MATTER - RECORDING TEMPERATURE

Name \_\_\_\_\_

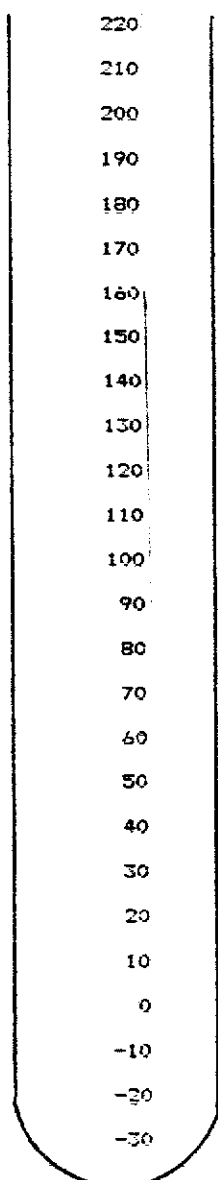
Color in the correct temperature for each state of matter.



ice cube  
°



melted  
°



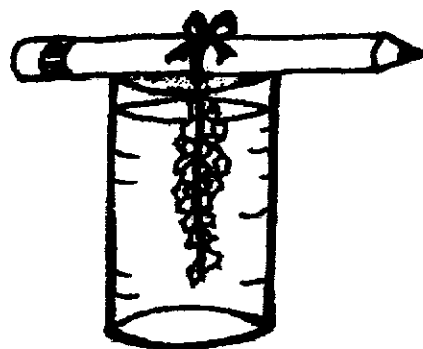
boiling  
°

## HOME EXPERIMENT: TURNING A LIQUID TO A SOLID - ROCK CANDY

Please DO NOT try this experiment without your parent's help.

You will need the following items to make rock candy.

- \* stove
- \* a small saucepan
- \* 1 cup of water
- \* 1 1/2 cups sugar
- \* a wooden spoon
- \* a large glass container
- \* a pencil
- \* a piece of clean cotton string (12 inches)



Follow these directions to make rock candy.

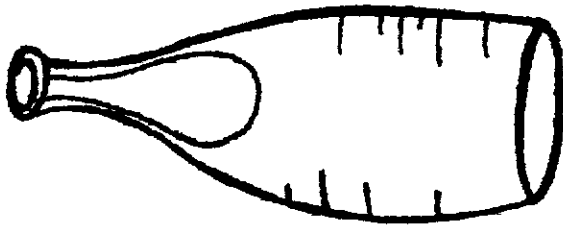
1. Have mom or dad boil the water on the stove in a saucepan and remove it from the stove.
2. Gradually pour the sugar into the hot water while continually stirring.
3. Let the sugar water cool down a little bit.
4. Pour the sugar water solution into the large glass.
5. Tie one end of the string around the center of the pencil.
6. Rub some sugar grains into the string. The sugar should be sticking to the string.
7. Drop the free end of the string into the sugar water solution. Rest the pencil on top of the glass. The string should be dangling into the water.
8. Store the glass in a cool, safe place where it will be undisturbed.
9. Wait a few days, then gently pull the string out of the water.
10. Enjoy your rock candy!

PREDICTION SHEET: WHAT IS A GAS?

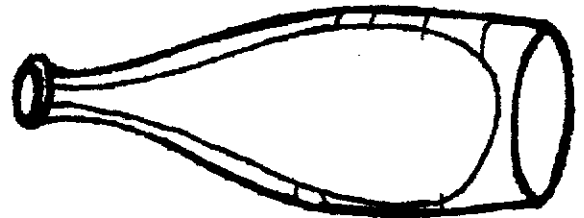
Name \_\_\_\_\_

STATION: HUFF -N- PUFF

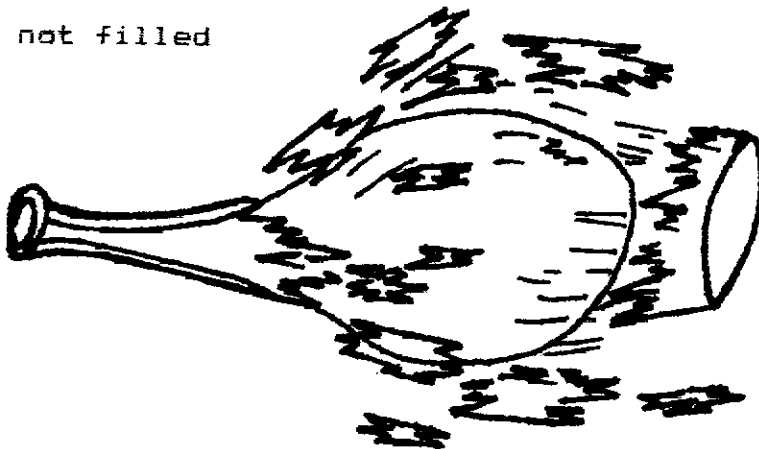
Circle the picture that best represents what you think will happen when you try to blow up the balloon inside the bottle.



not filled



filled



filled and exploding

Was your prediction right?



RIGHT

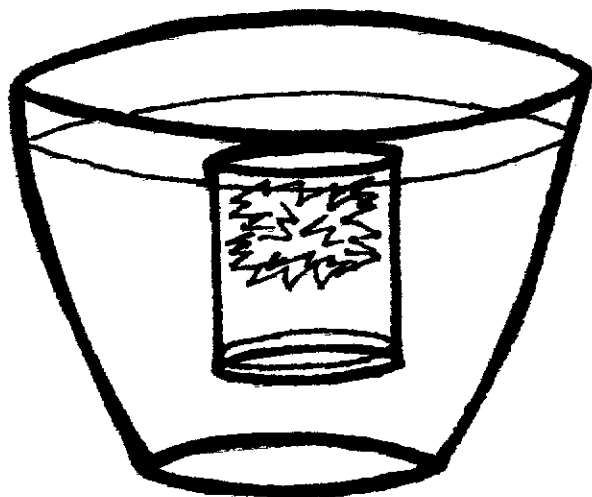


WRONG

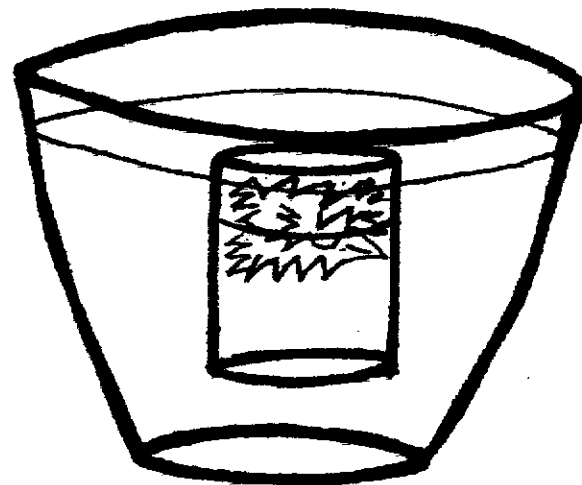
Name \_\_\_\_\_

## STATION: PAPER IN THE GLASS

Circle the picture that best represents what you think will happen when you place the upside down glass in the water.



dry paper towel



wet paper towel



wet and overflowing

Was your prediction right?



RIGHT



WRONG

## PREDICTION SHEET: ONLY YOUR NOSE KNOWS

Name \_\_\_\_\_

STATION: ONLY YOUR NOSE KNOWS

Circle the picture that best represents what you think will happen when you remove the cover from the bottle?



smell something



smell nothing

Was your prediction right?



RIGHT



WRONG

Can you see a gas? \_\_\_\_\_

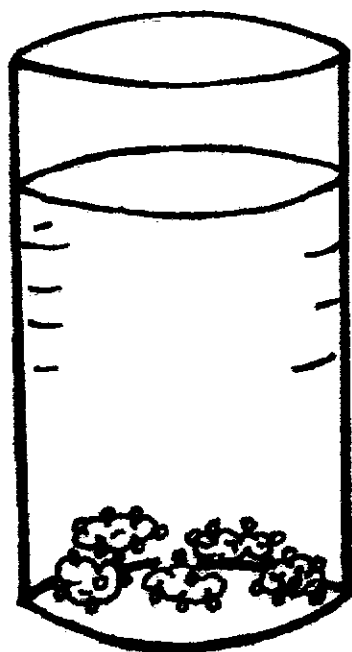
Can you smell a gas? \_\_\_\_\_

## PREDICTION SHEET: OFF TO THE RACES

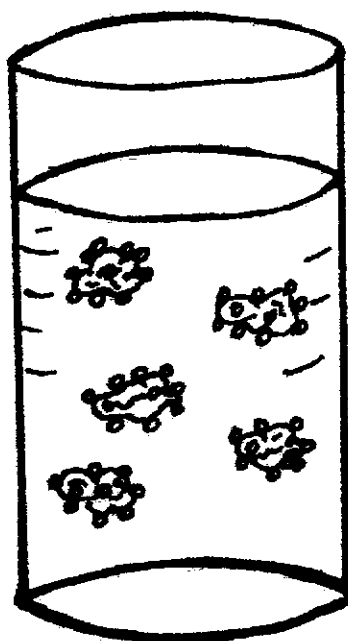
Name \_\_\_\_\_

STATION: OFF TO THE RACES

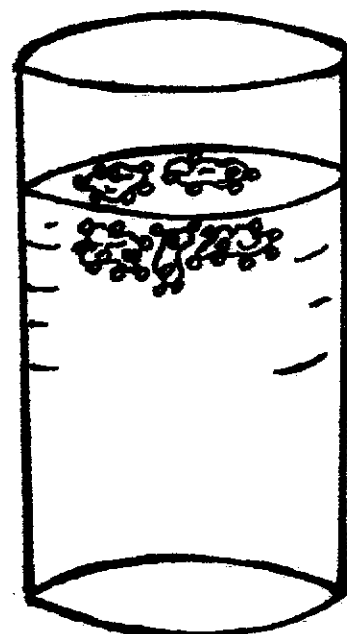
Circle the picture that best represents what you think will happen to the raisins when they are dropped into the soda.



sink



travel



float

Was your prediction right?

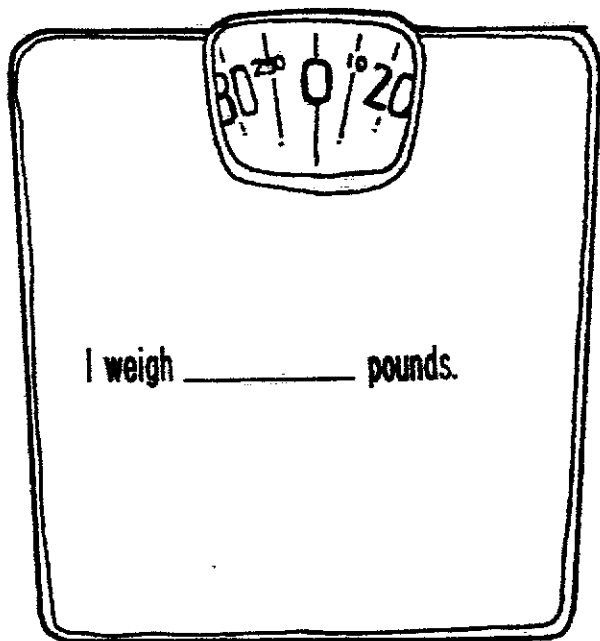


RIGHT



WRONG

Name \_\_\_\_\_

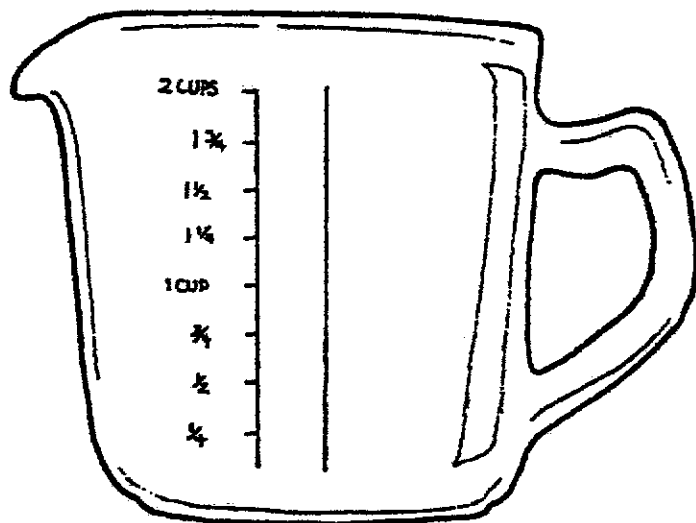


I am \_\_\_\_\_ tall. (ft./in.)

I am \_\_\_\_\_ tall. (cm)

There are \_\_\_\_\_ cups in a quart.

There are \_\_\_\_\_ quarts in a gallon.



## MATTER: ITS STATE AND PROPERTIES TEST

Name \_\_\_\_\_ Score \_\_\_\_\_ Grade \_\_\_\_\_

Fill in the blank: complete each sentence by writing the correct word or number in the blank.

4	6	12	4	3	1
ruler	scale	cup	thermometer		

- There are \_\_\_\_\_ cups in a quart.
- There are \_\_\_\_\_ quarts in a gallon.
- You would use a \_\_\_\_\_ to weigh yourself.
- You would use a \_\_\_\_\_ to measure how hot it is outside.

True or False: write a T in the blank if the statement is true; write an F in the blank if the statement is false.

- \_\_\_ The three state of matter are: gas, liquid, and solid.
- \_\_\_ Matter is something that takes up time and space.
- \_\_\_ Water can be frozen to be a solid, melted to be a liquid, and boiled to be a gas (steam).
- \_\_\_ Air is a gas that takes up space.

Matching: Place the correct letter in the blank.

- \_\_\_ solid
- \_\_\_ liquid
- \_\_\_ gas
- \_\_\_ temperature

