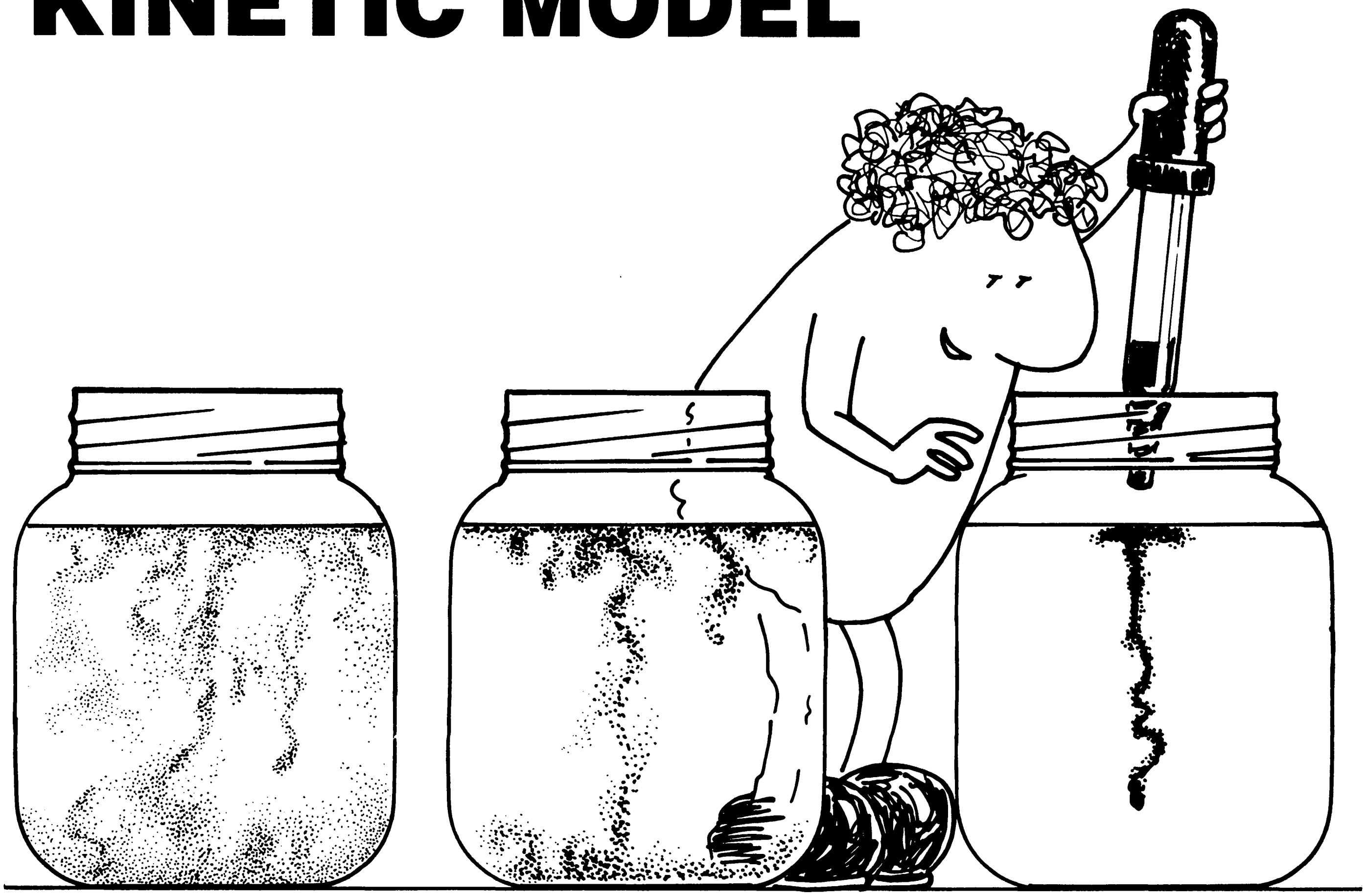
KINETIC MODEL



TASK CARD SERIES

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CONTENTS

Gathering Materials

Listed below is everything you'll need to teach this module. You already have many of these items. The rest are available from your supermarket, drugstore and hardware store. Laboratory supplies may be ordered through a science supply catalog.

Keep this classification key in mind as you review what's needed:

special in-a-box materials: Italic type suggests that these materials are unusual. Keep these specialty items in a separate box. After you finish teaching this module, label the box for storage and put it away, ready to use again the next time you teach this module.	general on-the-shelf materials: Normal type suggests that these materials are common. Keep these basics on shelves or in drawers that are readily accessible to your students. The next TOPS module you teach will likely utilize many of these same materials.
(substituted materials): Parentheses enclosing any item suggests a ready substitute. These alternatives may work just as well as the original, perhaps better. Don't be afraid to improvise, to make do with what you have.	*optional materials: An asterisk sets these items apart. They are nice to have, but you can easily live without them. They are probably not worth an extra trip to the store, unless you are gathering other materials as well.

Everything is listed in order of first use. Start gathering at the top of this list and work down. Ask students to bring recycled items from home. The teaching notes may occasionally suggest additional student activity under the heading "Extensions." Materials for these optional experiments are listed neither here nor in the teaching notes. Read the extension itself to find out what new materials, if any, are required.

Needed quantities depend on how many students you have, how you organize them into activity groups, and how you teach. Decide which of these 3 estimates best applies to you, then adjust quantities up or down as necessary:

Q_1 / Q_2 / Q_3

- **Single Student:** Enough for 1 student to do all the experiments.
- **Individualized Approach:** Enough for 30 students informally working in 10 lab groups, all self-paced.
- **Traditional Approach:** Enough for 30 students, organized into 10 lab groups, all doing the same lesson.

KEY: *special in-a-box materials* (substituted materials) general on-the-shelf materials *optional materials

1/10/10 rolls masking tape
1/10/10 scissors
1/2/2 *sheets pressed cardboard*
4/25/25 *milk cartons — quart or half gallon sizes*
2/2/2 sets milk carton objects — see notes 2
1/5/10 *magnets
1/10/10 plastic produce bags
1/1/1 pkg popcorn, unpopped
1/1/2 dictionaries
3/18/30 baby food jars (small jars)
1/1/1 source hot/cold water
1/1/1 cider jug or equivalent
1/1/1 bottle food coloring
1/1/1 wall clock with second hand (wristwatch or stopwatch)
.2/1/2 *meters narrow tubing, 1/8 inch diameter or less — see notes 5*
2/20/20 test tubes - at least half should be large capacity
.1/1/1 cup modeling clay (1-hole rubber stoppers)

1/10/10 eyedroppers
1/10/20 lab thermometers
1/4/10 lids for baby food (small) jars
1/1/1 roll aluminum foil
2/20/20 cups standard ice cubes
1/1/1 box table salt
1/1/1 roll paper towels
1/10/10 candles (may use Bunsen burners or alcohol lamps in some activities)
1/10/10 pkgs matches
1/10/10 wooden clothespins
.4/4/4 *cups snow or ice shavings — see notes 7
.2/2/2 cups wax shavings — see notes 8
1/4/10 *index cards — 4 x 6 inches
2/10/20 styrofoam cups
2/20/20 plastic sandwich bags
1/1/1 box paper clips
1/1/1 bottle rubbing alcohol
3/30/30 rubber bands
1/1/1 roll plastic wrap

5/50/50 straws
3/30/30 straight pins
1/2/5 paper punches
1/4/10 margarine tubs (bowls)
1/4/10 empty cans
1/4/10 magnifying glass
1/1/1 roll toilet tissue
2/20/20 quart jars with lids
1/1/1 roll string
1/1/1 *hot plate or radiator
1/5/10 plastic syringes — 3 cc capacity, no needles
1/10/10 *plastic 2 liter bottles with lids — see notes 16*
1/5/10 *twist ties (thin wire)*
1/4/10 hand calculators
1/2/5 rolls cellophane tape
3/30/30 birthday candles
2/20/20 size-D dry cells
1/4/10 graduated cylinders — 100 ml capacity
1/4/10 graduated cylinders — 10 ml capacity

Sequencing Task Cards

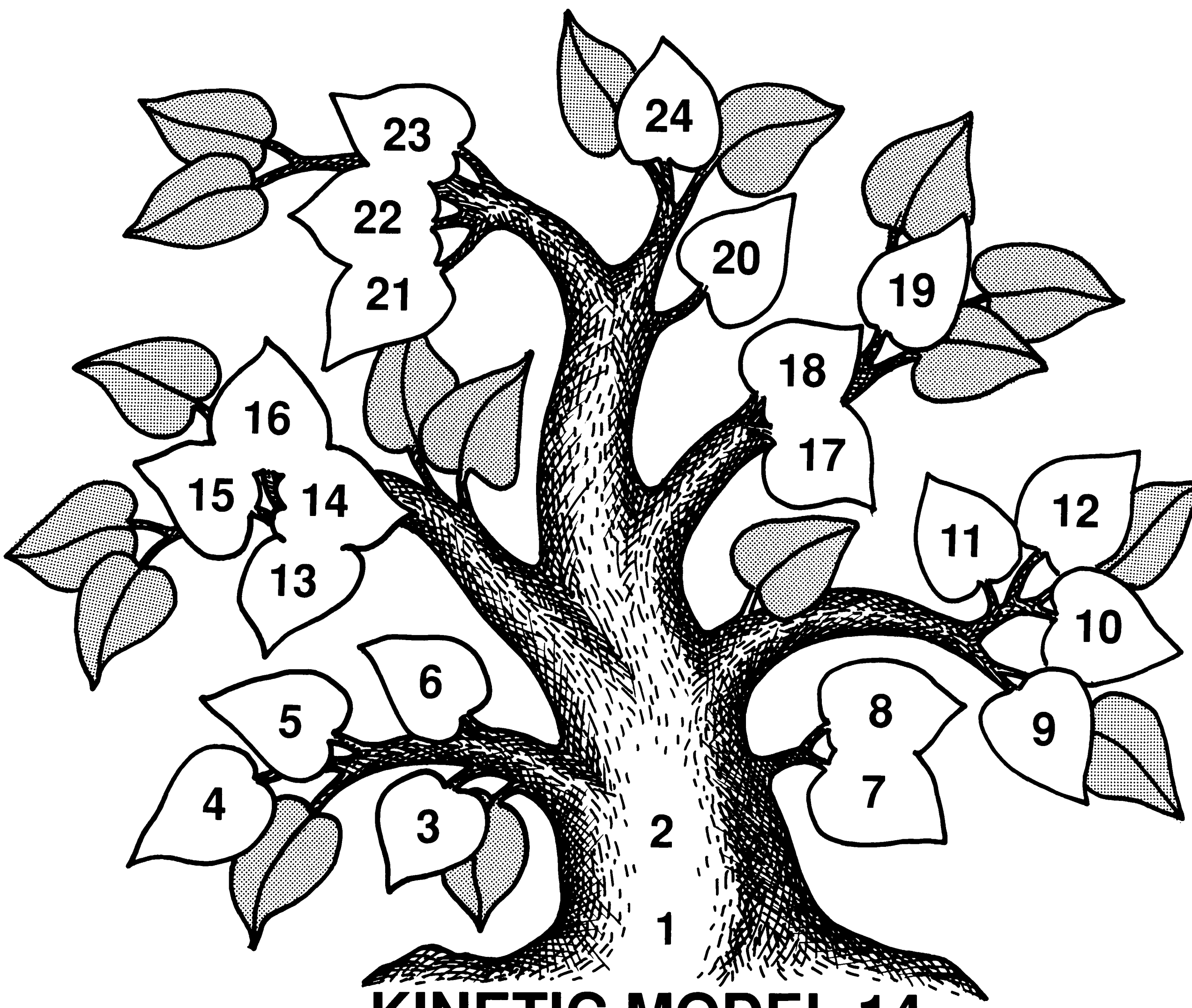
This logic tree shows how all the task cards in this module tie together. In general, students begin at the trunk of the tree and work up through the related branches. As the diagram suggests, the way to upper level activities leads up from lower level activities.

At the teacher's discretion, certain activities can be omitted or sequences changed to meet specific class needs. The only activities that must be completed in sequence are indicated by leaves that open *vertically* into the ones above them. In these cases the lower activity is a prerequisite to the upper.

When possible, students should complete the task cards in the same sequence as numbered. If time is short, however, or certain students need to catch up, you can use the logic tree to identify concept-related *horizontal* activities. Some of these might be omitted since they serve only to reinforce learned concepts rather than introduce new ones.

On the other hand, if students complete all the activities at a certain horizontal concept level, then experience difficulty at the next higher level, you might go back down the logic tree to have students repeat specific key activities for greater reinforcement.

For whatever reason, when you wish to make sequence changes, you'll find this logic tree a valuable reference. Parentheses in the upper right corner of each task card allow you total flexibility. They are left blank so you can pencil in sequence numbers of your own choosing.



KINETIC MODEL 14

Review / Test Questions

Photocopy the questions below. On a separate sheet of blank paper, cut and paste those boxes you want to use as test questions. Include questions of your own design, as well. Crowd all these questions onto a single page for students to answer on another paper, or leave space for student responses after each question, as you wish. Duplicate a class set and your custom-made test is ready to use. Use leftover questions as a review in preparation for the final exam.

task 1-2
A small child shakes the contents of a gift-wrapped box to try to guess what is inside. Is this child practicing science? Explain.

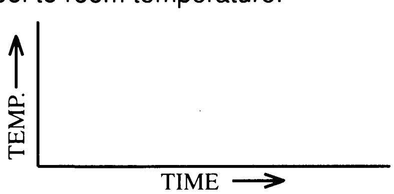
task 1-3
Devise a demonstration to show that air is a real substance even though it is invisible.

task 3-4
Devise an experiment using a bottle of perfume to show that perfectly still air is composed of molecules in constant motion.

task 3-5
Wet the rim of an empty glass beverage bottle, then lay a coin on top to seal it. Squeeze it tightly in your hands to make the coin jump. What is happening?

task 6-8 A
Identify 4 common phase changes in water. For each change, indicate if heat is taken in or given out.

task 6-8 B
Sulfur has a melting point of 113° C and a boiling point of 357° C.
a. Suppose you heat it to 200° C. Is it solid, liquid or gas at this temperature?
b. On the graph below, sketch how this compound cools over time if you remove it from the heat and allow it to cool to room temperature.



task 6-8 C
Water in a tea kettle boils at 100° C. Would touching the liquid burn you as much as touching the vapor? Explain.

task 7-8
Can you heat water without raising its temperature? Explain.

task 9
Never boil water in a sealed jar. Why is this dangerous?

task 10-13 A
Why does evaporation cool a liquid?

task 10-13 B
An empty glass takes on the same temperature as its surroundings.
a. Why is this not generally true if the glass is filled with water?
b. Under what conditions would this be true for a glass full of water? Explain.

task 11
You have a balloon and a bottle of perfume. Design an experiment to determine if the skin of your balloon is permeable to perfume molecules.

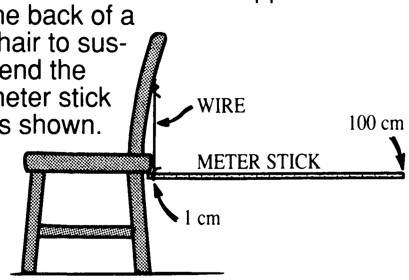
tasks 13, 14
A hygrometer hangs outside your house on a foggy day. The dry thermometer reads 10.0° C. What does the wet thermometer read? Why?

tasks 10, 14
Explain how a hygrometer measures moisture content in the air.

task 15-16 A
After hours of high speed driving across a hot desert road, you decide to pull off and check your tires. They look a little over-inflated, so you let out some air by pushing on each valve with your fingernail. Does the air feel warm? Explain.

task 15-16 B
Why does warm, moist air form clouds when it rises?

task 17-18
A wire is attached to a meter stick at the 1 cm mark and wrapped around the back of a chair to suspend the meter stick as shown.



a. What happens to the meter stick when the wire is heated with a candle flame, then allowed to cool?
b. If the length of the wire changes 1 mm, how far does the end of the meter stick move? Use similar triangles to illustrate your answer.

task 18-19 A
Strips of brass and iron are riveted together, then heated over a flame. If brass expands and contracts faster than iron, what can you expect to see?

task 18-19 B
To remove a tight metal twist-off lid from a glass jar, it is sometimes helpful to place the lid under hot water. Why is this effective?

task 20
Ten grams of ice at 0° C is placed in a jar. If the heat of fusion for water is 80 cal/gram, how many calories of heat are required to heat the water to 20° C? Show your work.

task 21-23 A
A balloon that is inflated to a volume of 600 ml at 20° C shrinks or expands 2 ml for each 1° C change in temperature. What is absolute zero according to this data?

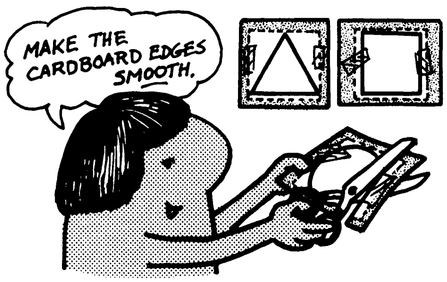
task 21-23 B
A Pyrex flask with a capacity of exactly 373 ml is heated to 100° C in an oven, then quickly inverted into an ice bath at 0° C. Exactly 100 ml of water is drawn into the flask.
a. What volume does the air in the flask occupy at 0° C?
b. Use this data to find the value of absolute zero.

task 24
Cooking recipes sometimes include special directions for high altitude locations. Why is this necessary?

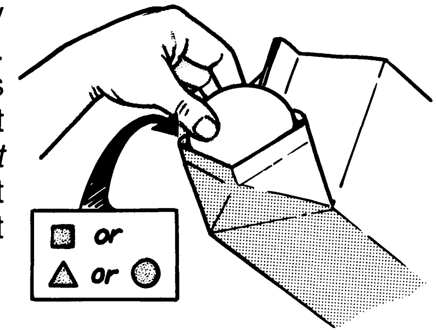
Task Objective (TO) devise ways to indirectly determine the shapes of cardboard patterns inside a milk carton.

INDIRECT EVIDENCE ○ Kinetic Model ( )

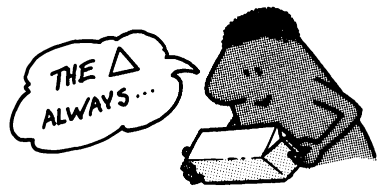
1. Tape the square, circle and triangle patterns to cardboard. Carefully cut out each shape.



2. Put one shape into a clean, dry milk carton. Invent ways to identify it *without* touching it or looking at it directly.



3. Refine your methods until you can correctly identify each shape that a friend hides inside. Explain your technique.



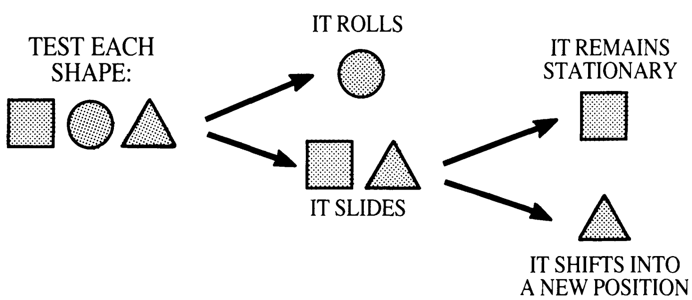
4. Scientists tell us that air is made from tiny *molecules* that are too small to see. How can they know about things they haven't seen?

 1

Answers / Notes

2. *This step does not involve guessing. Students already know what shape they put inside. The task here is to invent ways to turn and tilt the carton that will consistently discriminate among the possibilities.*

3. Turn the carton sideways and on edge so the figure slides into a "trough." Tilt this trough so the figure shifts to the carton's bottom and listen carefully. If it rolls it must be the circle. If it slides it could be the square or triangle. After it stops, slowly tip the carton into a vertical position and listen carefully. If it remains stationary it is the square. If it shifts to a new position it is the triangle.



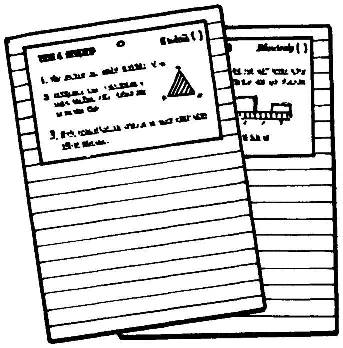
4. As in this experiment, the nature of things unseen can be inferred indirectly by observation or experiment. The presence of unseen air molecules, for example, is easily detected as a cool breeze against the face or a breath of fresh air.

Materials

- ☐ Masking tape.
- ☐ Scissors heavy enough to cut cardboard.
- ☐ A square, circle and triangle pattern. Photocopy these from the supplementary page at the back of this book.
- ☐ Heavy pressed cardboard. Recycle a Grape-Nuts cereal box, or use the back of a writing tablet. Index cards and corrugated cardboard don't work as well.
- ☐ A waxed or plasticized paper milk carton. Quart or half gallon sizes are both suitable.

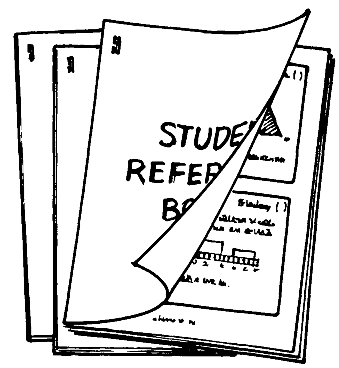
Task Cards Options

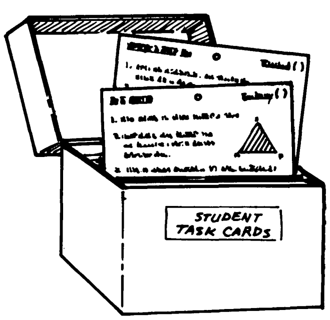
Here are 3 management options to consider before you photocopy:



1. Consumable Worksheets: Copy 1 complete set of task card pages. Cut out each card and fix it to a separate sheet of boldly lined paper. Duplicate a class set of each worksheet master you have made, 1 per student. Direct students to follow the task card instructions at the top of each page, then respond to questions in the lined space underneath.

2. Nonconsumable Reference Booklets: Copy and collate the 2-up task card pages in sequence. Make perhaps half as many sets as the students who will use them. Staple each set in the upper left corner, both front and back to prevent the outside pages from working loose. Tell students that these task card booklets are for reference only. They should use them as they would any textbook, responding to questions on their own papers, returning them unmarked and in good shape at the end of the module.





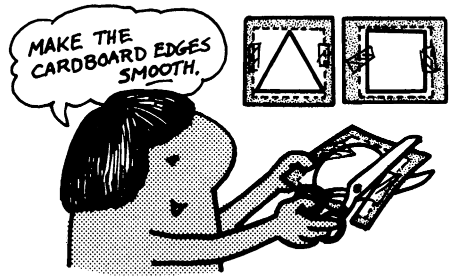
3. Nonconsumable Task Cards: Copy several sets of task card pages. Laminate them, if you wish, for extra durability, then cut out each card to display in your room. You might pin cards to bulletin boards; or punch out the holes and hang them from wall hooks (you can fashion hooks from paper clips and tape these to the wall); or fix cards to cereal boxes with paper fasteners, 4 to a box; or keep cards on designated reference tables. The important thing is to provide enough task card reference points about your classroom to avoid a jam of too many students at any one location. Two or 3 task card sets should accommodate everyone, since different students will use different cards at different times.

INDIRECT EVIDENCE

O

Kinetic Model (   )

1. Tape the square, circle and triangle patterns to cardboard. Carefully cut out each shape.



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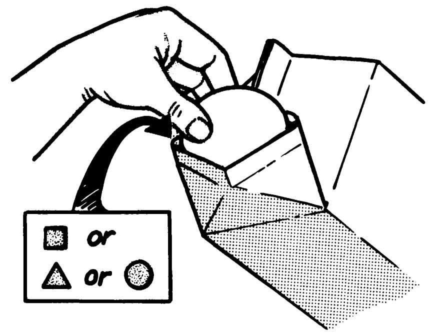
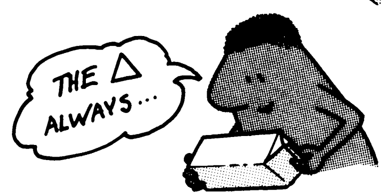


3. Refine your methods until you can correctly identify each shape that a friend hides inside. Explain your technique.



4. Scientists tell us that air is made from tiny *molecules* that are too small to see. How can they know about things they haven't seen?

MODELING UNKNOWNS

O

Kinetic Model (   )

1. Get a sealed "mystery box." Experiment to determine the properties of the object inside, without unsealing your box.
   a. Sketch the size and shape of each object inside.
   b. Cite experimental evidence to support your drawing.
   c. Compare the properties of each unknown object to known objects that you put inside a second milk carton.

2. Name a physical property of your object that you can't be sure about.

3. Repeat these steps with other mystery boxes coded with other letters.

4. To correctly model real-world science, is it fair to remove the tape from any mystery box and peek inside? Defend your answer.