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ABSTRACT

These materials were developed for in-service workshops for K-8 teachers as part of the Winston-Salem/Forsyth County Metric Education Project. A teacher (or team of two) from each school was trained in a series of six 3-hour sessions using hands-on measurement activities. Teachers in turn were responsible for conducting 10 1-hour in-service sessions in their own schools. The materials are written for the leaders of the school phase of the inservice education project. Each of the 10 chapters contains specific instructions on how to conduct the session. These instructions are divided into the following categories: (1) In Advance; (2) You Need; (3) Suggested Activities; (4) Assignment; and (5) Notes. Following each instruction sheet, the details of the lesson plan are given including background materials for the sessions, written materials needed, transparency suggestions, etc. The 10 chapters are: (1) Background and Status; (2) Temperature, Time and Money; (3) Non-Standard and Arbitrary Units; (4) Linear-Centimeter; (5) Linear-Meter, Etc.; (6) Area-Squares; (7) Volume-Cubes; (8) Capacity-Liquids; (9) Man-Weight-Force; and (10) Vocabulary-Form-Symbols. (MP)

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METRICS THE MEASURE OF YOUR FUTURE

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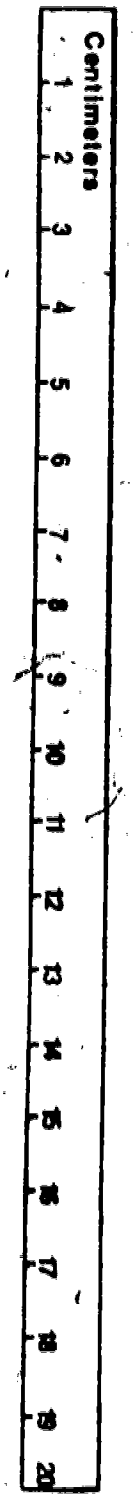

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

ALL TOGETHER NOW - TEACH METRICS

For use in the Winston-Salem/Forsyth County School System

Dr. James A. Adams, Superintendent
C. Douglas Carter, Special Assistant for Instruction

ESEA Title IV-C - Grant No. 69-77-028
Division of Development, North Carolina Department of Public Instruction

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ALL TOGETHER NOW — TEACH METRICS!

Contents

	Page
Preface	i
1. Background and Status	1
2. Temperature, Time, and Money	8
3. Non-Standard and Arbitrary Units	14
4. Linear - Centimeter	19
5. Linear - Meter, Etc.	24
6. Area - Squares	29
7. Volume - Cubes	33
8. Capacity - Liquids	38
9. Mass - Weight - Force	43
10. Vocabulary - Form - Symbols	48
Teacher Survey (Pages 1, 2, and 3)	

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Instructional Materials Development Center
2720 South Main Street
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PREFACE

These materials were developed for in-service workshops for K-8 teachers as part of the Winston-Salem/Forsyth County Metric Education Project - ESEA Title IV-C. A teacher (or team of two) from each school was trained in a series of six three-hour sessions, using these hands-on measurement activities along with some from the North Carolina State Department of Public Instruction, Mathematics Division (Dr. Robert R. Jones, Director).

These MetriContact teachers in turn are responsible for conducting ten one-hour in-service sessions in their own schools during afternoon planning time (so no stipends are required, though the MetriContact receives a nominal amount for outside preparation.)

The activities were chosen as representative of the kind that have proven most effective in project school classrooms. Most of them can be reused as is or easily adapted by the teacher, depending on the grade level involved. During the introductory stages, material is seldom too easy or under level, as it will become in a couple of years. This is true for teachers and for students; all need a geat variety of non-threatening activities, especially those that encourage conversational use of metric terms and actual use of measurement tools.

The objectives of these ten in-service sessions are.

(1) that teachers understand the reasons for change to SI and the process involved;
(2) that teachers become familiar with the new language of measurement and comfortable in its use;
(3) that teachers gain experience with the new units for length, area, volume, capacity, mass, and temperature, and the tools that measure them; and
(4) that teachers become aware of developmental sequences in measurement learning and some effective teaching techniques.

Besides these ten in-service sessions, teachers in the WS/FC system have been involved in other staff development programs aimed at correlation of student behavioral objectives with texts of the various disciplines and selection of supplementary materials and equipment for classroom use.

Testing of student performance will begin in May; that will be considered a pre-test, making this year's work a sort of trial run. The same test given a year later will be called a post-test, to determine whether students have about reached grade level as indicated by project school records after a comparable interval. Our experience indicates that both students and teachers will need about two years to achieve a real grade-level efficiency, though both can develop common measurement skills within a relatively short period of time.

There are two possibilities good teachers will avoid:

(1) postponing all work with metrics until they are sure they know the whole system (they didn't wait until they knew the whole customary system!), or
(2) trying to get the whole job done this year by making metrics a new course of study in the curriculum, neglecting other areas.

A moderate approach is needed. The change to metrics is not a "once-and-for-all" event. It can be achieved easily if done calmly, with constant reinforcement; it need not be hammered in!

Hints For The Teacher*

1. Concentrate on teaching measurement - use metric units. Before children can understand any measurement system, they must have many experiences with measuring. There are many skills (reading scales; using rulers, beakers, balances; counting units; names of units; relationship of units to things measured; etc.) that should precede any study of metrics as a system.

2. Use metric units every time you measure, in all subject areas. This is essential to the understanding that metrics is "for real."

3. Teach prefixes and symbols as they are needed - the complete set need be expected only of older students, when you stress the logic and simplicity of metrics as a system.

4. Use actual units and measuring instruments. The degree of accuracy needed may vary with the purpose at hand, but should stay within a reasonable range. Stress that measurement is always approximate, not exact.

5. Estimate, then check by measuring, once the unit is fully identified. (This same principle should be used in many basic arithmetic operations.)

6. Begin with linear measure - the centimetre for young children, the metre for intermediates or older. Work with it until students are comfortable with it before pushing other units.

7. Avoid the use of common fractions with metric units - decimal notation is preferred if parts of units must be considered. In early grades, choice of suitable units prevents this problem.

8. Don't spend a lot of time on conversions between units within the system. Students must learn relationships between units, but will not need conversion skills often.

9. Don't fight a metre-meter, litre-liter spelling battle, but insist on correct symbols. Use the term mass when using balance scales - this is important for proper development of science vocabulary. Weight will probably remain in popular usage with either mass or force.

10. Teach metrics as the system - refer to other units as "old style." Teach conversions only if they are really needed for a specific real situation - as when old style data must be compared with new metric data. Use the most generalized comparison consistent with the data; always convert old data to new metric form, so that use of the data will then procede in metrics. Do not create such situations! Do relate units to common objects and body measurement.

*Based on recommendations of Interstate Consortion on Metric Education

TO: METRICONTACT TEACHERS SESSION 1: BACKGROUND AND STATUS

In Advance:

(1) Arrange to have a film "A Metric America" (5-8),"Metric Measure Made Easy"(K-6), or an introductory or background filmstrip if convenient.

(2) Put up a notice asking teachers to bring their copies of the Parent's Guide to Homework - specify beginning and ending time along with place and date.

(3) Prepare an attendance sheet headed "Metrics Workshop - Sept. 1, 1976" for them to sign in on.

You Need:

(1) Appropriate projector for film or filmstrip if used

(2) An overhead projector if available

(3) Your school's metric kit and/or other materials on display so teachers can see what is available

(4) Some metric stations set up (at least height and weight)

Suggested Activities:

(1) Show film or filmstrip.

(2) Give pre-test - seriously - but do not take up papers.

(3) Use "The Metric System" overhead (call attention to the fact these are overhead masters and should not be marked on). Point out root words and discuss how prefixes join with each. Refer to table on page 15 of Parent's Guide.

(4) Complete the Metric Reader sheet - check together.

(5) Use any remaining time for stations and materials display.

Assignment:

Learn the three root words, the six prefixes, and their symbols. Look over page 11 of the Parents' Guide, especially 1795, 1866, 1893, 1975.

Note:

A Parent's Guide to Homework is being reprinted now. More about its use in the near future!

Check with your principal to see that proper application has been sent to Dr. Sandefur. This is vital. Certificate renewal credit may be given only if proper application is on file in the office of Program Services and their requirements on reporting are met.

Metric System: BACKGROUND AND STATUS

There is no law saying we must use metric measurement now. BUT, in 1974, Congress passed Public Law 93-380 "to encourage educational agencies and institutions to prepare students to use the metric system." This was soon followed by a policy statement from the North Carolina State Board of Education to the effect that public schools should increase their teaching of metrics each year so that by 1981 metric measurement is taught as the primary system of measurement. The date is geared to mathematics textbook adoptions, but the policy is not limited to mathematics.

Latest in the series of edicts is Public Law 94-168 to set up the United States Metric Board to coordinate activities throughout all areas of change - business, industry, education, etc. The president nominates the seventeen members and Congress must confirm them.

The Winston-Salem/Forsyth County School Board and administrative staff, through their initiation and support of the Metric Education Project - ESEA Title III - and other activities, have taken a leadership position in the State in moving toward a metric curriculum. And North Carolina is one of five states (with California, Mississippi, Minnesota, and Maryland) being given special grants for metric project development.

During Phase I of the Winston-Salem/Forsyth Metric Education Project, teachers at the project schools (Brunson and Wiley) attended workshops, investigated materials, and began developing a curriculum.

In Phase II, plans they had made were tried out and materials were evaluated. By the end of that second year, their curriculum was determined, activities were selected, and tests were developed. At the same time, MetriContact teachers were trained to begin the process of change throughout all the K-8 schools in the county. In May, pre-testing of students was done in the project schools.

Now in Phase III, the project schools will serve as demonstration sites for the system and area, open on a regular basis for visits by teachers and administrators. Workshops will be available in all other K-8 schools with MetriContacts serving as coordinators and project staff providing materials and other assistance. At the end of Phase III, post-testing will be done in the project schools to determine whether the project approach does indeed lead to the desired result. At the same time, pre-testing will be done in the other schools.

Throughout the process, an effort is being made to enlist the help and support of parents and others in the community. To that end, the Parent's Guide To Homework is being widely distributed, and such special events as a booth at the Dixie Classic Fair, exhibits at Hanes Mall, and Metric Week activities were initiated last year by the Metrics Advisory Council and will be repeated in Phase III. With all K-8 schools in the community involved in this effort to teach students the system they will use almost exclusively as adults, and with increasing movement toward metric usage throughout all sectors of the economy, every effort must be made to secure parent participation in this very important part of their child's education.

PRETEST - METRIC MEASUREMENT WORKSHOP

Distance

1. How many yards to a mile? _____
2. A 60-knot wind blows how many miles per hour? _____
   " " feet per second? _____
3. How many feet to a furlong? _____
4. Which is the largest unit, the rod, the fathom, or the link? _____
5. How many feet in a rod? _____ a fathom? _____ a link? _____

Area

6. How many square feet in a square mile? _____
7. A barometer reading of 30.14 means _____

Volume

8. Which is larger in size, a dry quart or a liquid quart? _____
   by how much? _____
9. How many quarts in a peck? _____
10. How many gallons in a barrel? _____
11. How many cubic inches in a cubic yard? _____
12. How many pounds of water does a barrel hold? _____
    (Water weighs about 60 pounds per cubic foot.)
13. How many quarts of water in a square foot? _____

Mass

14. How many grains to a common ounce? _____
15. How many pounds to a hundred weight? _____
16. Which is larger, the Troy pound or the common pound? _____
    by how much? _____
17. How many pounds to a long ton? _____
18. A cubic yard of water weighs about how many ounces? _____
19. How many cubic feet in a cord of wood? _____
20. Which weighs more, an ounce of gold or an ounce of feathers? _____

Miss a few? That may not be too bad; at least those don't have to be unlearned before you can change over to metric measures. This is adapted from a self quiz developed by Dr. Anton de S. Brasunas, University of Missouri, Rolla, who is a regional director of the U. S. Metric Association. Published in the American Metric Journal, it included a report that the average score is 4! Feel Better? Now you can start with a new system so simple and easy that it has swept around the world. GO METRIC!

PROBABLE ANSWERS TO PRETEST

1. 1,760 yds. = 1 mile

2. (a) 1.1508 miles/hour = 1 knot 69.048 miles/hour = 60 knots
   (b) 1.6878 feet/second = 1 knot 101.268 feet/second = 60 knots

3. 660 ft. = 1 furlong

4. rod > fathom > link

5. 16.5 ft. = 1 rod 6 .66

6. 27,878,400 sq. ft. = 1 sq. mile

7. Height of a column of mercury 30.14 inches high

8. Dry by 9.45 cu. in.

9. 8 dry qts.

10. 31 if wine, 42 if petroleum, standard 31.5

11. 46,656

12. depends on the barrel (see 10) One gallon weighs 8.337 lb. at 62°F

13. None!

14. 437.5 grains = 1 ounce avoirdupois

15. 100 or 112 lb. = 1 hundredweight

16. 1 lb. Troy < 1 lb. avoirdupois by 1,240 grains

17. 2,240 lbs. = 1 long ton

18. 26,968.875 oz. = 1 cu. yd. water

19. 128 cu. ft. = 1 cord of wood

20. ounce of feathers (avoirdupois) (437.5 grains) < ounce of gold (Troy) (480 grains)

Some of these may be debated, depending on the table or reference you use.

THE METRIC SYSTEM

• KILO	• HECTO	• DEKA	root < gram / meter / liter	• DECI	• CENTI	• MILLI
thousands	hundreds	tens	units	• tenths	hundredths	thousandths

NOTE: The decimal always follows the unit named.

For a useful transparency, cut in two just above the decimal point. Using a clear overlay and an erasable pen, write the number being considered in proper position under the metric terms. The lower half can then be moved left or right to demonstrate the ease of converting units within the system.

THE METRIC READER

Consider this sentence:

The rug is 4.75 m long.

meters	decimeters	centimeters	millimeters
4	.	7	5

This is usually read:

The rug is four point seven five meters long.

It means 4 metres and 75 centimeters, just as $4.75 means 4 dollars and 75 cents. Notice that the symbol m is for meters; the decimal always follows the unit named.

Or another example:

The table is 37.5 cm wide.

3	7	.	5

This would be read:

The table is thirty-seven point five centimeters wide.

It means 37 centimeters and 5 millimeters.
The symbol cm determines the decimal place.

One more example:

The rod is 2.138 m long.

2	.	1	3	8

This should be read:

The rod is two point one three eight meters long.

It means 2 meters and 138 millimeters.

Now read these and write the words they represent:

1. 6.84 m _____
2. 14.6 cm _____
3. 152.8 km _____
4. 91.3 mm _____
5. 7.427 m _____

METRICS FOR '76

1. Measure your height in centimeters. _____
2. Measure your weight in kilograms. _____
3. Measure your handspan in millimeters. _____
4. Measure your chest in centimeters. _____
5. Measure the length of the room in meters. _____
6. Measure the width of a fingernail in millimeters. Is it close to 10 mm wide? _____
7. Use the tape to measure your armspan. Compare with your height (in cm). _____
8. Find something about one meter from the floor. _____
9. Find the area of the stamp in square centimeters. _____
10. Start with a liter of "coffee" (water). How many cups of "coffee" could you serve? _____
11. How many drops of water fill a teaspoon? _____
12. How many teaspoons of water fill the cup to the 20 ml mark? _____
13. How many grams does a nickel weigh? _____
14. Measure 50 grams of sand (including the weight of the cup). _____
15. Find the weight in grams of your pen or pencil. _____
16. Hold the bulb of the thermometer between your two palms. Read the temperature in degrees Celsius. _____

Use this kind of activity when you are called on to "do something on metrics" for a group of friends, a club meeting, etc. Choose easy, one-operation-only activities, and keep the number small. A few, remembered, are better than many, forgotten!

TO: METRICONTACT TEACHERS TEMPERATURE - TIME - MONEY

In Advance:

(1) Record attendance from previous session but save the sign in sheets. You might ask if anyone forgot to sign in. Prepare new sheet with date.

(2) Remember to save one copy of each work sheet in your notebook, in case anyone wants to duplicate it for classroom use.

You Need:

(1) Filmstrip on temperature, if available

(2) Demonstration thermometer

(3) Celsius thermometer

(4) Red and white construction paper or tagboard

(5) Meter sticks and rulers

(6) Overhead projector

Suggested Activities:

(1) Use a filmstrip on temperature. Get everyone to talk about weather and temperature.

(2) Call attention to bulletin board, "The Celsius Way," suggested by Lynn Faust and Mary Ann Palmer. Another good one divides the board into quarters for the four seasons, with a thermometer at the center. Pockets in each section hold appropriate pictures brought by children.

(3) Complete the Milli puzzle and or use the much longer one in your notebook.

(4) Review terms with "The Metric System" overhead.

(5) Complete [illegible] sheet.

(6) Make Demo thermometer and weather chart (sample enclosed).

Assignment:

Tell at least one person outside the workshop what you have learned [illegible]

Notes: "The Celsius Way" [illegible]

[illegible]

[illegible]

But We've ALWAYS Used Customary. . .

Many units of measure have served man in the past - our customary system has been an accumulation from many sources. Even the way we count these units reflects ancient history. The Romans counted by twelves - so we have had 12 inches in a foot, 12 hours on the clock face, and twelve eggs in a dozen. The Greeks counted by twenties - from them came a score of years and 20 grains to the scruple. The Babylonians based many calculations on 60 - we know 60 seconds make a minute (or an angular degree), 60 minutes make an hour, and 60 minims make a fluidram. Others lost in antiquity used a binary system - 2 cups make a pint, 2 gallons make a peck, and units are divided into halves, fourths, eighths, and sixteenths. Interestingly, the two-digit system is the basis for our modern computers and all our electronic technology.

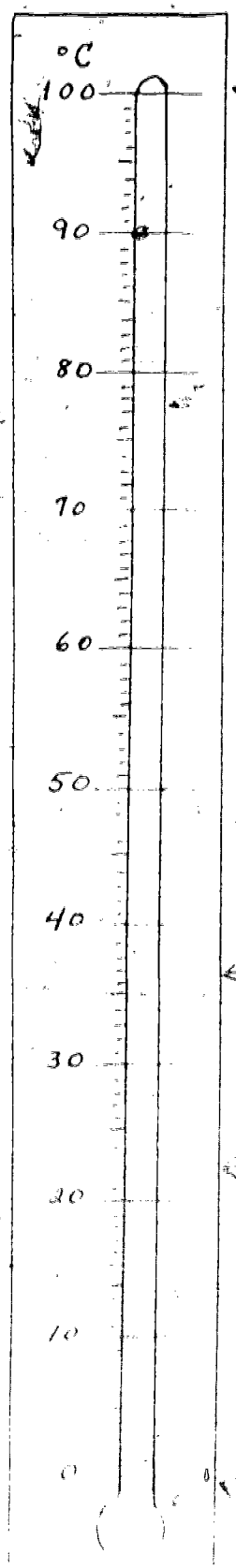
The popularity of our favorite system based on 10's almost certainly came from the genetic factors that gave most of us ten fingers. As a base, ten has no mathematical superiority over 3, 5, 8, 16 or any of the others; but it is very satisfactory for everyday use, as proven by our experience with the dollar.

From the teaching standpoint, it has several real advantages. Foremost is its widespread acceptance and use. It has become the primary system for counting throughout the world. The decimal usage built into it makes mathematical operations relatively simple and easy to understand, both for whole units and for parts.

The metric system was developed to make these advantages available in the counting of all units, whatever kind of measurement they may represent. Certainly it is bothersome for us to have to learn new names for units, but the advantage of having all our daily operations in one system will far out-weigh the inconvenience. The new units in themselves have no important significance, but the ease with which they can be used has led to world-wide acceptance.

Again from the teacher's standpoint, it will mean concentrating on one system, decimal in nature, with rational numbers decreasing in emphasis (but not disregarded). Students will learn to use all kinds of measurements in arithmetic operations as they do dollars and cents - and at the same time, common fractions will probably be sequenced to fit the science curriculum, with ratio and proportion introduced along with work problems. We will still [illegible] proportions - half the class, a third of the [illegible], etc. And [illegible] "a quarter to four" when the [illegible] work day ends. But arithmetic operations on fractions may well be [illegible] until they can be handled [illegible] typical [illegible].

[illegible] computation of areas [illegible] the child's developmental [illegible]

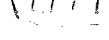


Water boils at
100°C

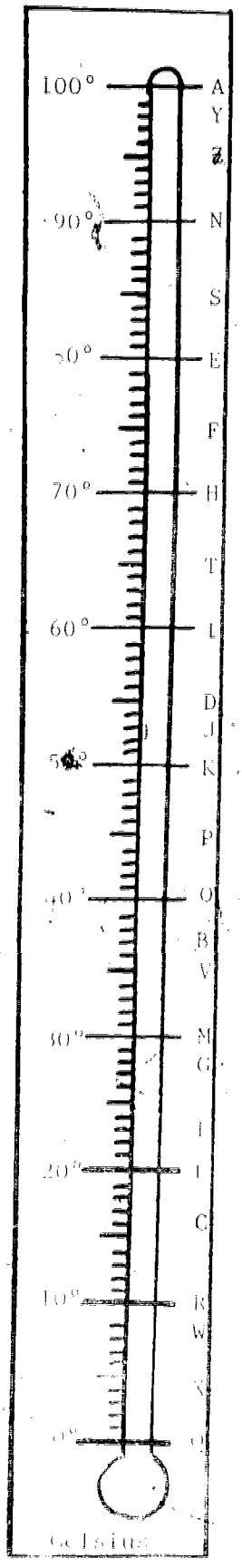
THE CELSIUS WAY

Human body Temperature
37°C

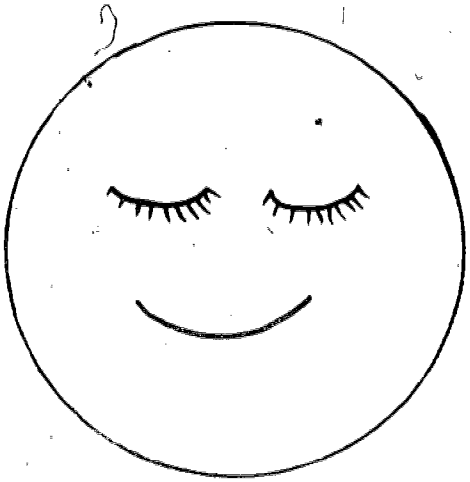
Room Temperature
22°C



Water Freezes
0°C



Milli says,



2	12					6	9	9	1														
U																							
Ex.	10	12				7	3	12															
11	12	7	8	5	6					10	4	10	7	12	11								

Find the letter beside the temperature given in each example. Write the letter over the example number in the puzzle. Notice that some answers are used more than once.

EX. → 20° → U

1. 23°
2. 37°
3. 70°
4. 98°
5. 60°
6. 16°
7. 65°
8. 10°
9. 40°
10. 85°
11. 30°
12. 80°

METRIC MONEY - Now, Really!

Suppose the same principles used in the metric system had been incorporated into our money system. The Greek word would probably have been kept-daler. Then, using the prefixes common to other units, we would have:

THE DALER		
kilodaler -	$1000.000 -	one thousand dalers
hectodaler -	$100.000 -	one hundred dalers
dekadaler -	$10.000 -	ten dalers
daler -	$1.000 -	one daler,
decidaler -	$0.100 -	one-tenth of a daler, or dime
centidaler -	$0.010 -	one-hundredth of a daler, or cent
millidaler -	$0.001 -	one-thousandth of a daler, or mill

Nearly two hundred years ago when our country was young and such decisions were being made, five dekadalers ($50.000) would buy a whole section of fertile land in North Carolina, so the mill would have had real value. (Now you can hardly spend a cent.)

But notice one very important point. Our forefathers chose a decimal system for their dollars, just as is used in the metric system. In our money, 10 mills make a cent, 10 cents make a dime, 10 dimes make a dollar. For that we can be profoundly grateful even though the founding fathers rejected the same idea for other measurements.

Another thing to notice is that, with the mill in daily use, we would regularly have used three places after the decimal, just as we will when dealing with accurate lengths. Try writing these total amounts as one figure.

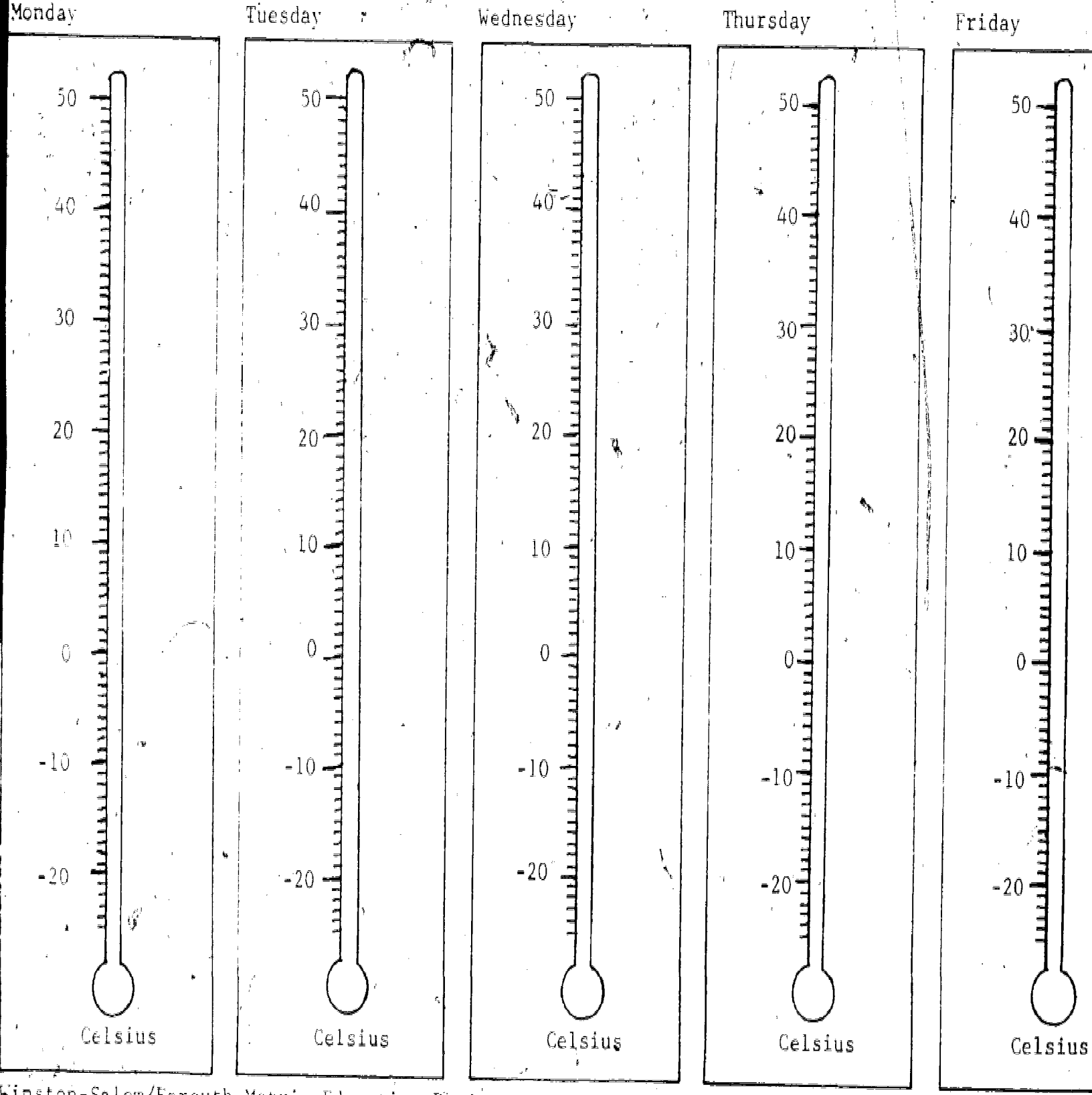
3 dalers, 4 dimes, 9 cents, 2 mills $\_\_\_\_\_$

7 dalers, 0 dimes, no cents, 8 mills $\_\_\_\_\_$

9 meters, 6 decimeters, 2 centimeters, 5 millimeters $\_\_\_\_\_$ m

2 meters, no decimeters 1 centimeter, 4 millimeters $\_\_\_\_\_$ m

Week of _____ Weather



Winston-Salem/Forsyth Metric Education Project - ESEA Title III

TO: METRICONTACT TEACHERS NON-STANDARD AND ARBITRARY UNITS

In Advance:

(1) Record attendance of previous sessions - save sign in sheet - prepare a new one.

(2) Select the activity sheets you will use with cuisenaire rods and duplicate them.

You Need: select from NoTall

Cuisenaire Rods and (Activities 1-8) from notebook materials

OR

Several boxes of jumbo gem paper clips from school warehouse (5 cm x 1 cm)

Suggested Activities:

(1) Worksheets with rods if possible, if not, use paper clips as a unit and measure everything easily at hand. Have them make a list on back of worksheet.

(2) Using the thoint as a unit, measure five objects of varied size. Record.

(3) In small groups, devise a measuring system using the jumbo clip as a unit; report results to group and compare.

(4) Using clips as a unit, devise a non-standard exercise suitable for use at your grade level.

(5) Complete these sheets - use the Milli puzzle as a ruler by folding along the edge.

Assignment:

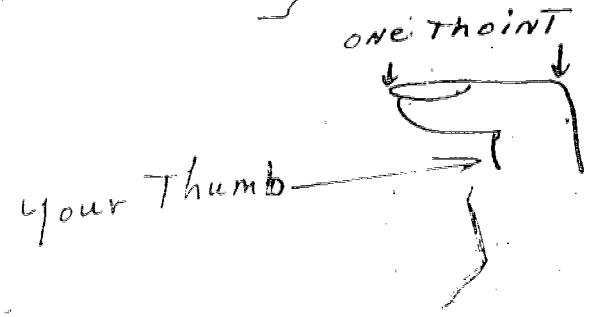
Talk about what you have done to someone not in the workshop.

NOTES:

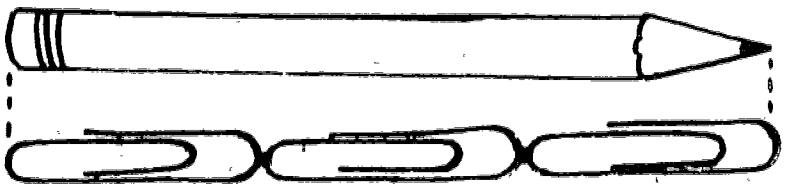
(1) Paper clips illustrate measurement with non-standard units. Remeasure with jumbo clips. Discuss problems.

(2) The Milli puzzle is for visual familiarization with cm units.

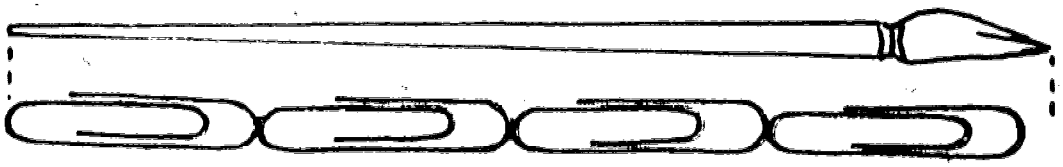
(3) The "fork" sheet is introductory to measuring with cm; the "brush" page introduces idea of "estimate, then measure." Some familiarity with the unit is neccessary before guessing is productive.



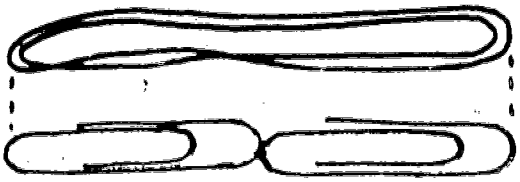
Write the length of each thing to the nearest paperclip.



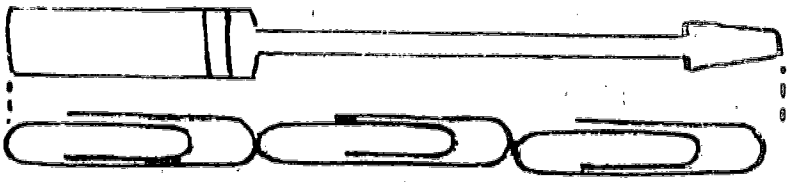
The length of the pencil is about _____ paperclips.



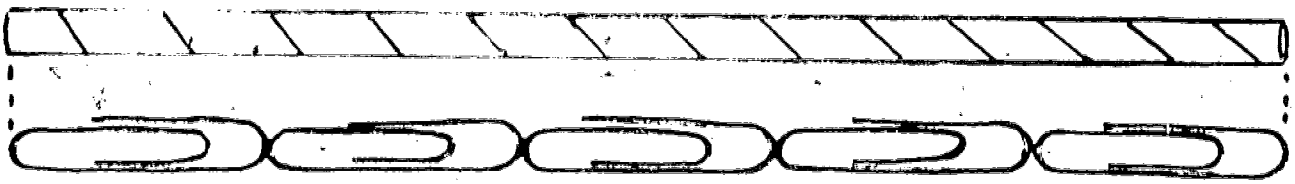
The length of the brush is about _____ paperclips.



The length of the rubber band is about _____ paperclips.

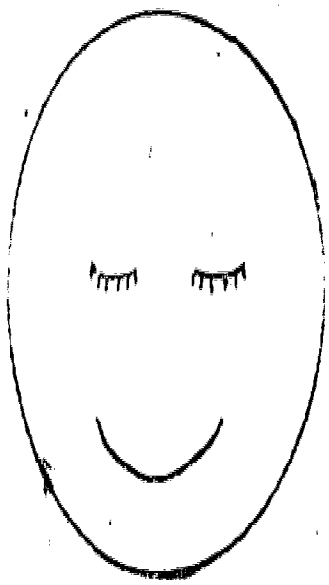


The length of the screwdriver is about _____ paperclips.

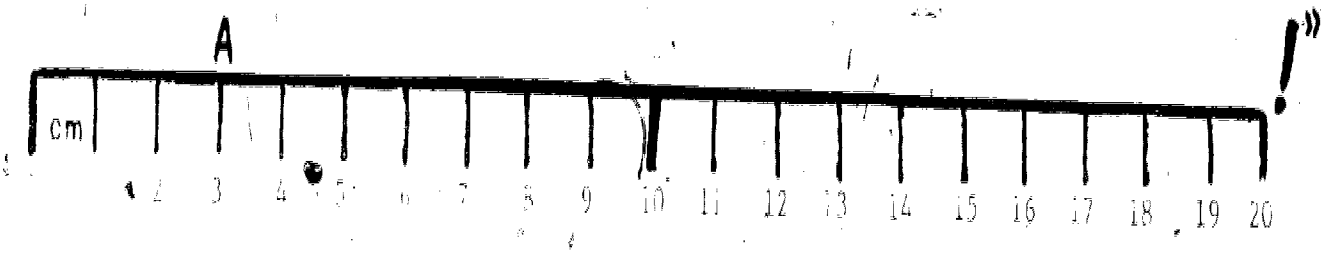


The length of the straw is about _____ paperclips.

Milli says,



"It really is fun to



!"

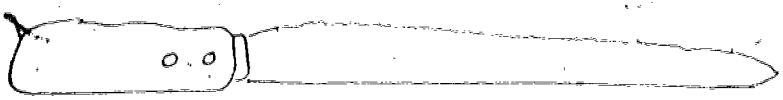
Write the letters over the [illegible] on the metric ruler; [illegible] that some go in more than one place.

A → 3		I	10, 18
W	9	R	6, 17
U	5	T	11, 16
H	12	S	4, 20
C	19	M	1, 14
		E	2, 7, 15

Use your metric ruler to measure these things.

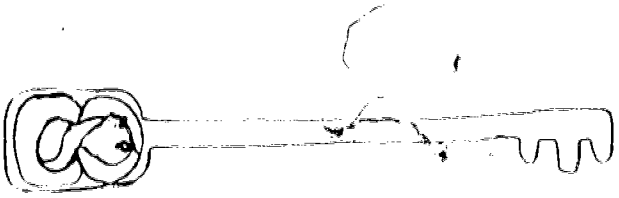
____ centimeters

____ centimeters



____ centimeters

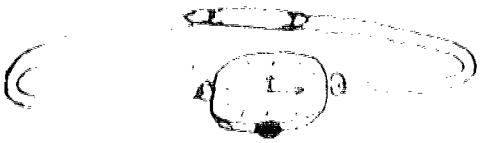
____ centimeters



____ centimeters

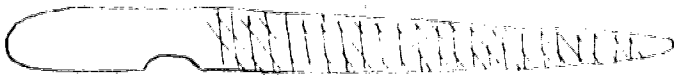
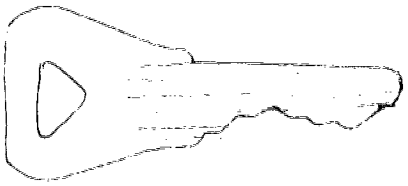
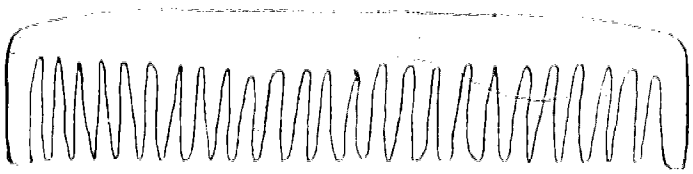
____ centimeters

____ centimeters



____ centimeters

Guess how long each thing is, then measure it.

	GUESS	MEASURE
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm
	____ cm	____ cm

TO: METRICONTACT TEACHERS LINEAR - CENTIMETER

In Advance:

Record attendance from previous session. Save sheet. Prepare a sign in sheet for this session.

You Need:

(1) Filmstrip on length, if available, and projector
(2) Rulers
(3) Several cubes with numbers 1-6 (don't call these dice).

Suggested Activities:

(1) Filmstrip, if used
(2) Find Milli's message - note continued emphasis on the cm markings. Use as a ruler for other sheets if desired.
(3) Play the game - note that it requires counting skill only to six. It increases familiarity with the cm unit. Stress that students need to work a long time with the cm and meter before they work with other units.
(4) Note that, to raise the grade level of Milli's Measure Each Line or Andy Ant you can specify measurements to nearest millimeter, using decimal notation (example, 3 cm 2 mm = 3.2 cm). This is a good time to emphasize rounding off - four or less, discard; five or more, add one unit (example, 3.4 cm = 3 cm rounded off, 3.5 cm = 4 cm rounded off).

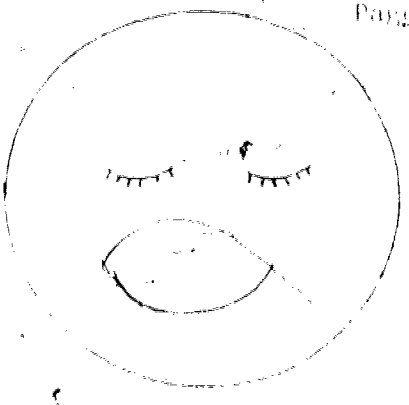
Assignment:

(Hope they complain that this was not enough material! Be sure they talk a lot about metrics.) Measure 6 objects at home in cm or mm.

NOTES:

(1) Milli's Secret Message is for visual familiarization with a scale containing mm markings.
(2) Milli's Measuring practice sheet introduces linear measurements in whole cm. Fold the "message" sheet so the ruler can be used for measuring.
(3) The birthday cake game is a simple counting game which should encourage repeated saying of the word centimeter.
(4) Andy Ant is a more advanced counting and addition exercise.

Milli has a secret message for her friends. To make her code, she put an A over 1 cm, B over 2 cm, and so on to the end of her ruler. Then she made her message look like lists of measurements. Can you find her message for you?



List No. 1

13 cm ___
5 cm ___
20 cm ___
18 cm ___
9 cm ___
3 cm ___

List No. 2

13 cm ___
5 cm C
1 cm A
19 cm ___
21 cm ___
18 cm ___
5 cm ___

List No. 4

5 cm ___
1 cm ___
11 cm ___
25 cm ___

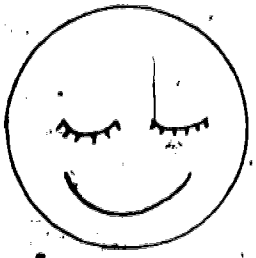
List No. 3

9 cm ___
19 cm ___

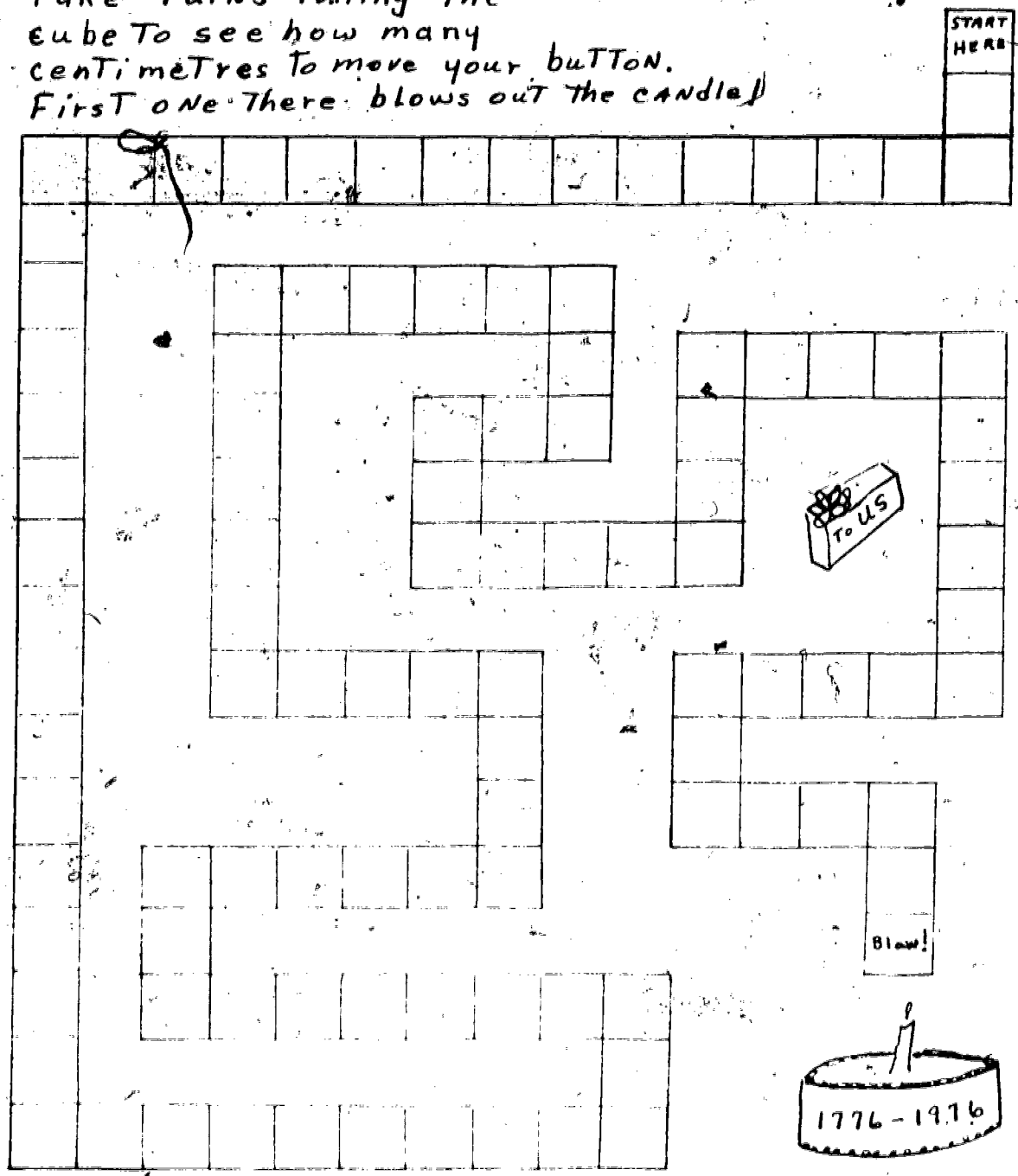
Be sure to write all the letters!

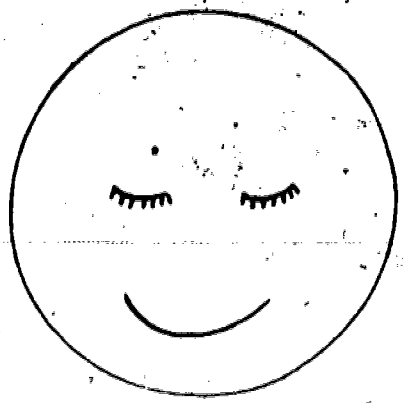
Milli has made a Birthday Cake.

For her party you need: 1 friend
2 buttons
1 cube with numbers



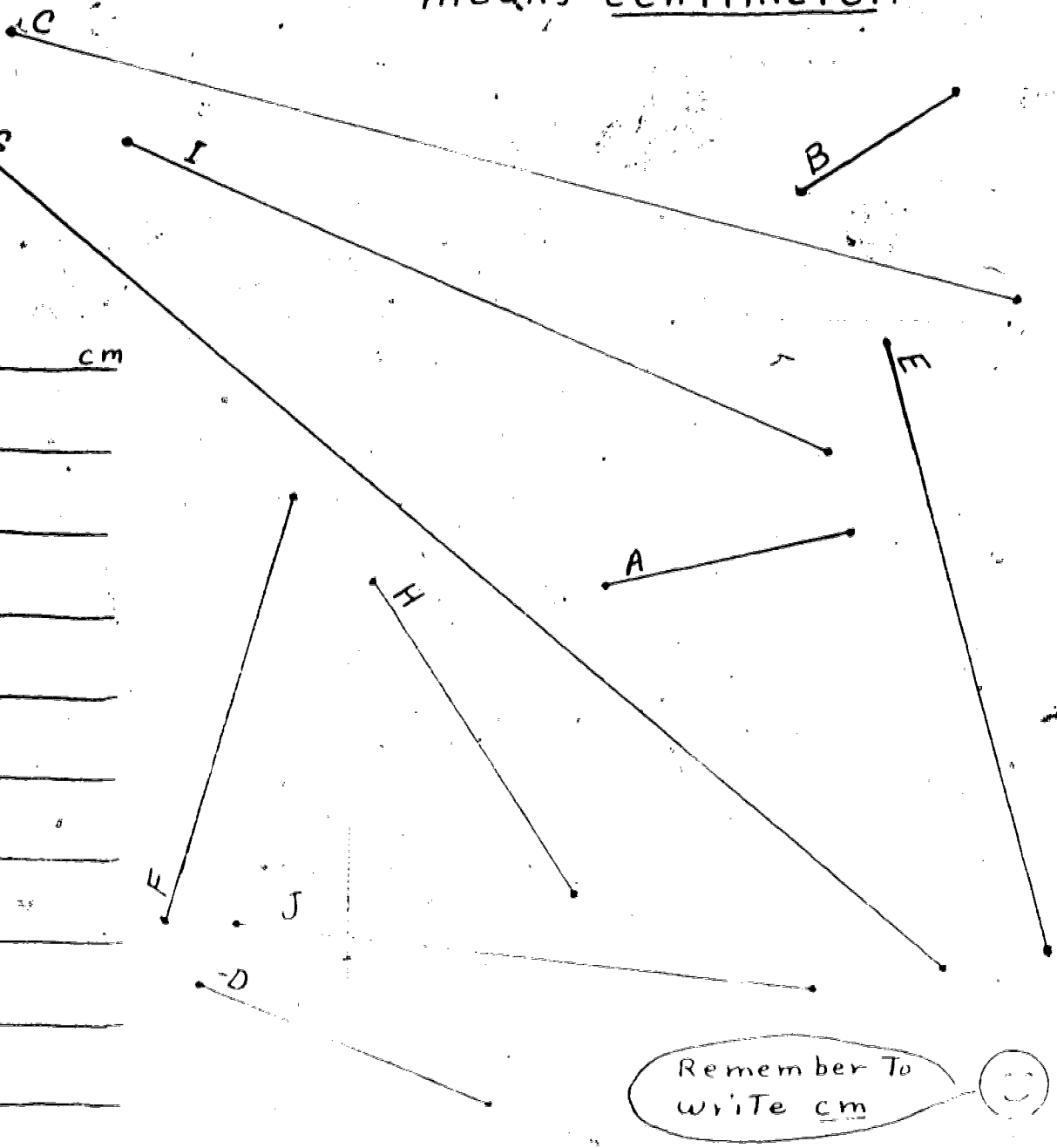
Take Turns rolling the cube To see how many centimetres to move your button. First one There blows out the candle!





Milli says,

"Measure each line and write the number of centimeters after the letter. Remember, cm means centimeter."



A ____ cm
B ____
C ____
D ____
E ____
F ____
G ____
H ____
I ____
J ____

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Andy Ant is hungry and looking for a cookie. Use your ruler To find how far he Traveled To **eat** The cookie.

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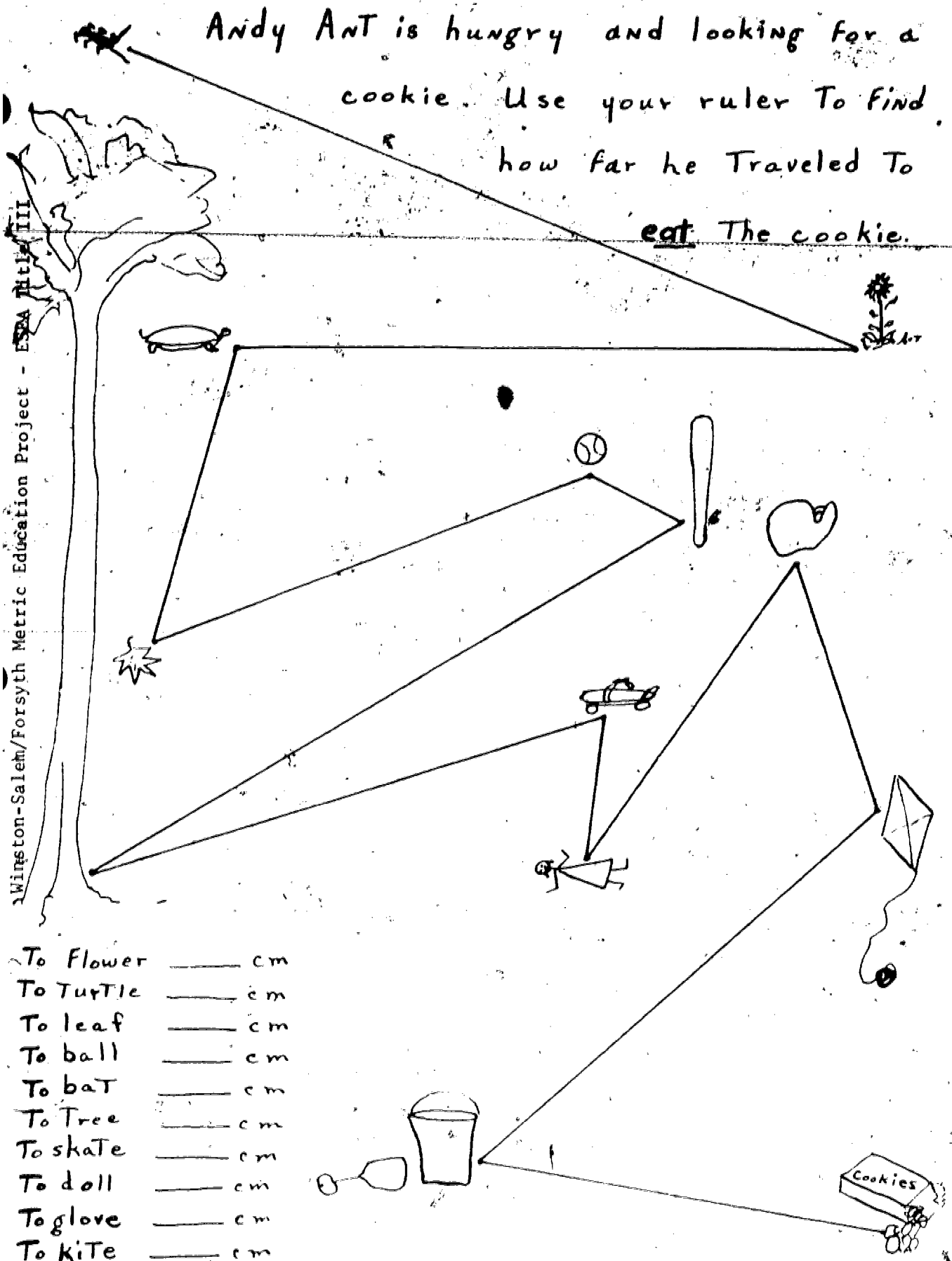


To Flower ____ cm
To TurTle ____ cm
To leaf ____ cm
To ball ____ cm
To baT ____ cm
To Tree ____ cm
To skaTe ____ cm
To doll ____ cm
To glove ____ cm
To kiTe ____ cm
To pail ____ cm
To cookie ____ cm

ToTal Trip ____ cm

TO: METRICONTACT TEACHERS LINEAR - METER, ETC.

In Advance:

(1) Record previous attendance; save sheet. Prepare a new sheet.
(2) Ask teachers to collect shade ends (any store that sells shades will give you cut-off ends).

You Need:

(1) Scissors
(2) Glue and/or masking tape
(3) Magic markers
(4) Tag board or sentence strips
(5) Meter sticks
(6) Trundle wheel
(7) Personal scale - (really should be out every time!)

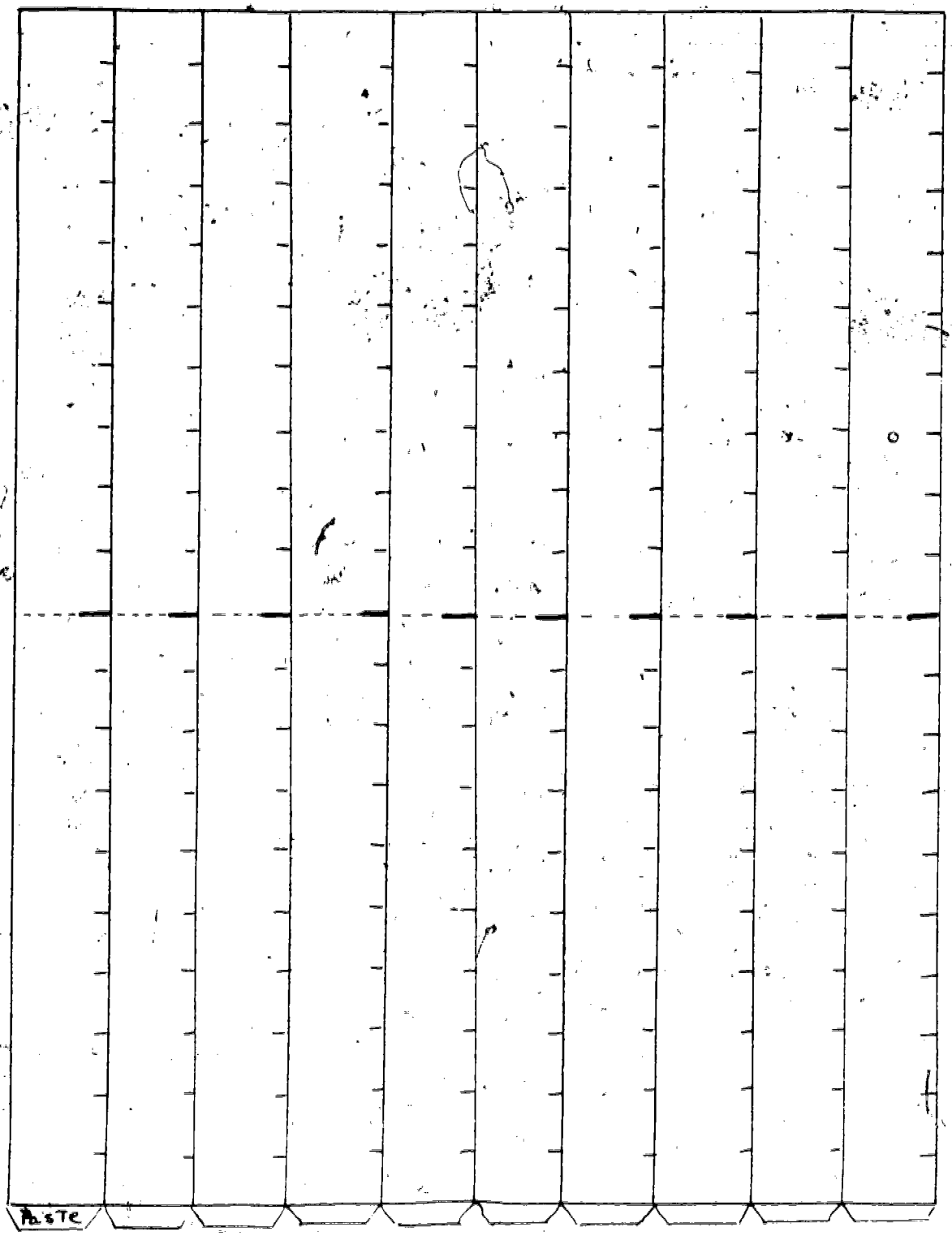
Suggested Activities:

(1) Make the 2-meter tape
(2) Complete Centimeters To Go Around (work in pairs)
(3) Suggest, for class use, making the tape at school, completing a sheet at home for student and friend or family member.
(4) Make height measures on tagboard or permanent one on a window shade end.
(5) Have each one make a list of five addition and five subtraction problems based on the map suitable to grade level.
(6) Use a trundle wheel and/or meter sticks to measure and mark a 10-meter (in a hall?) and a 100-meter distance (front walk?). Leave marks for students to see.

NOTES:

(1) The one-meter folding meter measure (10 dm) (pattern in your notebook) is best when you first introduce the meter as a unit, especially at lower grade levels. The two-meter measuring tape is accepted better by older students - they can number only at decimeter intervals if they wish. Handled with reasonable care, it will last. If you do not have a commercially-made tape to keep in your room (50¢ at Woolworths) you can reinforce the back with masking tape for more durability.
(2) Centimeters To Go Around is an important activity - it makes metric measure personal. Along with this, remind them to check own weight in kilograms.
(3) The North Carolina distances were converted (wash my mouth with soap!) from a road map table. Maybe someone will do a better North Carolina map and let us reproduce it for everyone.
(4) Note that Milli's Find the Line is self-checking, since correct responses make a message (Thank You, Gwen Jones!)

Make a two-meter measuring tape. Cut out the strips and paste or tape together (put the tape on the back). Number it. Roll it up, or fold it and keep it in a book.



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CENTIMETERS TO GO AROUND

Use a metric tape measure to find out some important information about yourself. First, see if you can find a measurement (fingernail, finger width?) that is just one centimeter. Then find your:

foot length ____cm

handspan ____cm

armspan ____cm

height ____cm

head ____cm

neck ____cm

wrist ____cm

chest ____cm

waist ____cm

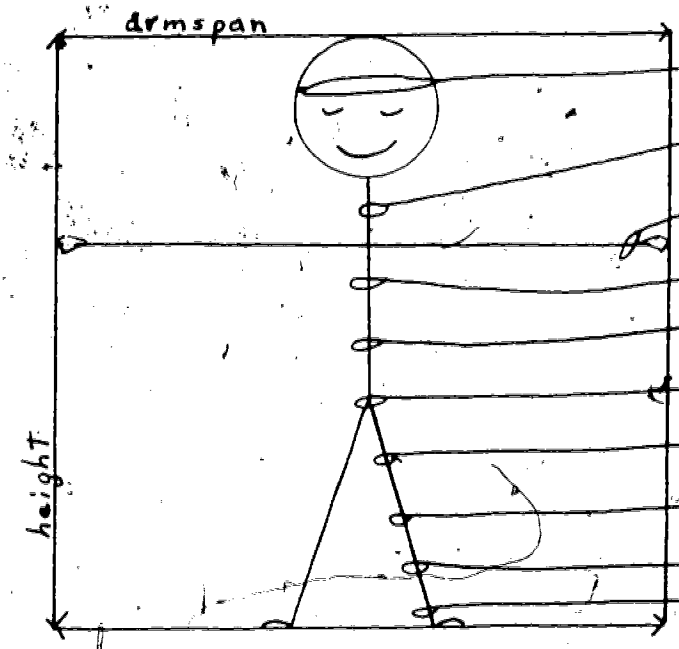
hips ____cm

thigh ____cm

knee ____cm

calf ____cm

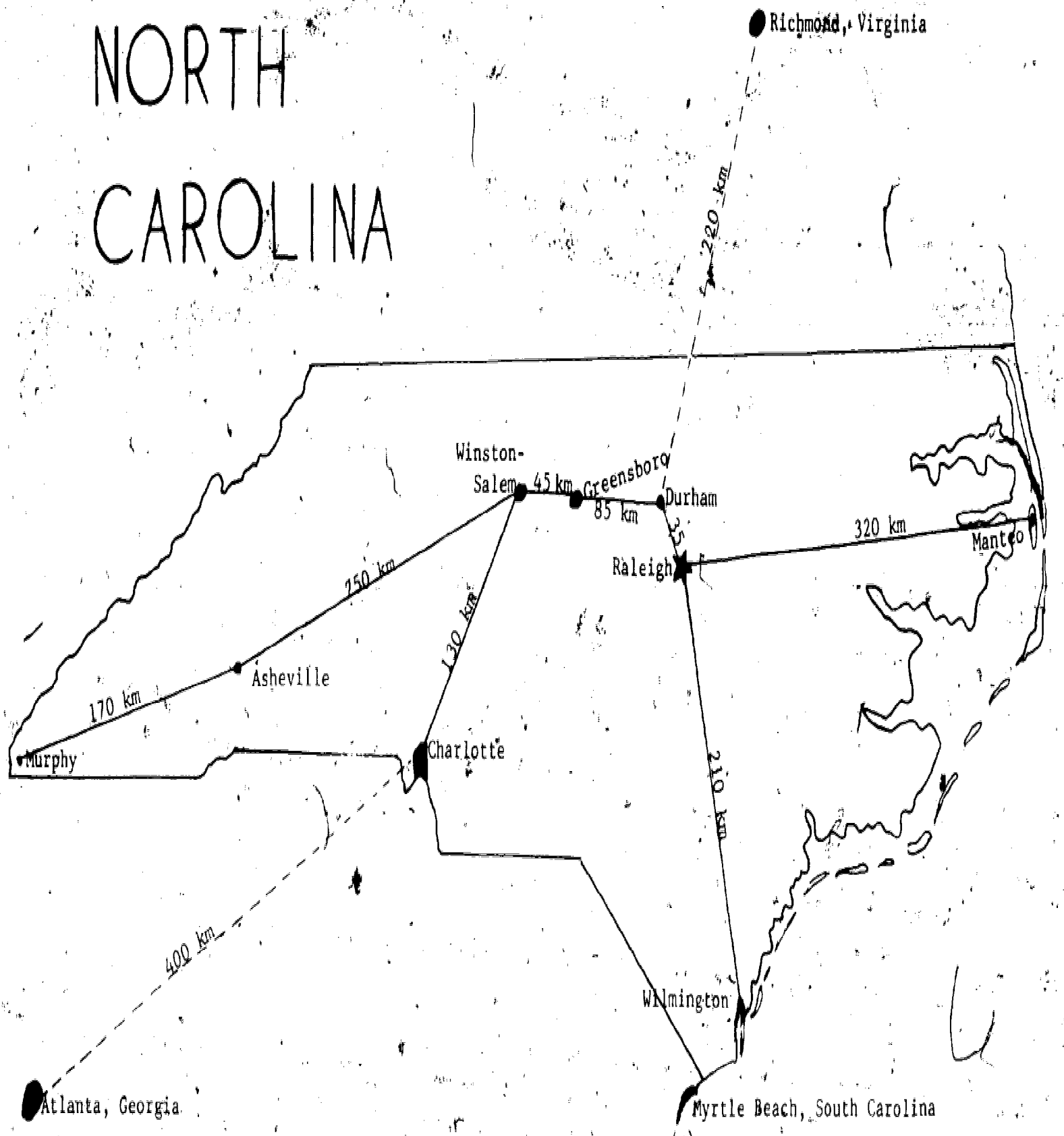
ankle ____cm

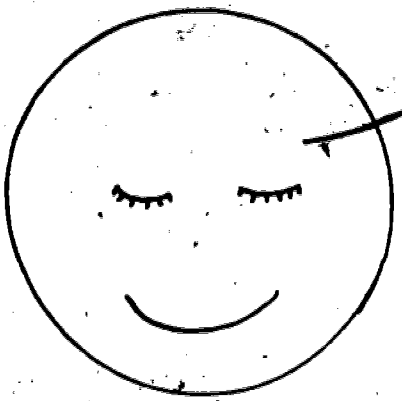


Compare your height and your armspan. If you were in the picture above, would the figure look like this  or this  or this  ?

Dr. Neil Solomon in his popular medical column gives these "ideal" proportions: "...for a well proportioned figure, your ankle should measure one-and-a-half times your wrist. Your calf should measure twice your wrist and your thigh three times your wrist. Your waist should be four times your wrist, and your hips and bust six times your wrist measurement."

If your measurements fall within a 5-to 8-centimeter range in certain spots, your body is still well proportioned. Check your's out!


NORTH
CAROLINA
Richmond, Virginia
220 km
Winston-
Salem
45 km
Greensboro
85 km
Durham
320 km
Manteo
Raleigh
250 km
130 km
Asheville
170 km
Murphy
Charlotte
210 km
400 km
Wilmington
Atlanta, Georgia
Myrtle Beach, South Carolina



Milli says,

"Find the line and write the letter.
Remember, cm means centimeter
and dm means decimeter."

1 cm ___
2 cm ___
3 cm ___
4 cm ___
5 cm ___
8 cm ___
11 cm ___
1 dm ___
2 dm ___
12 cm ___

L

O

E

O

I

D

I

K

U

Remember
10 cm = 1 dm

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TO: METRICONTACT TEACHERS AREA - SQUARES

In Advance:

Record previous attendance - save sign in sheet - prepare a new one.

You Need:

(1) A filmstrip on area, if available, and projector
(2) Transparent grids and/or grid paper
(3) cm cubes
(4) Scissors
(5) Old newspapers
(6) Masking tape

Suggested Activities:

(1) Measuring With Squares - emphasize that area is expressed as the number of squares that will fit into a given plane space. After guessing, use transparent grids to check. Or cover the figure with cubes, then count.
(2) On the back of a sheet, trace the outline of your hand. Count the square centimeters of area - count only those squares with more than half inside.
(3) Just Plane Squares - persuade them to cut out the figure and cut along the dotted line. DO NOT introduce area formulas, although this may lead to discussion of such.
(4) Make a square meter pattern out of newspaper. Use patterns to estimate the area of the room in square meters. These activities should concentrate on the size and shape of m^2 and cm^2. Or use masking tape or plastic tape to mark off a m^2 on the floor.

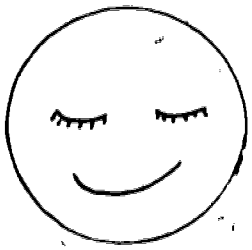
Assignment:

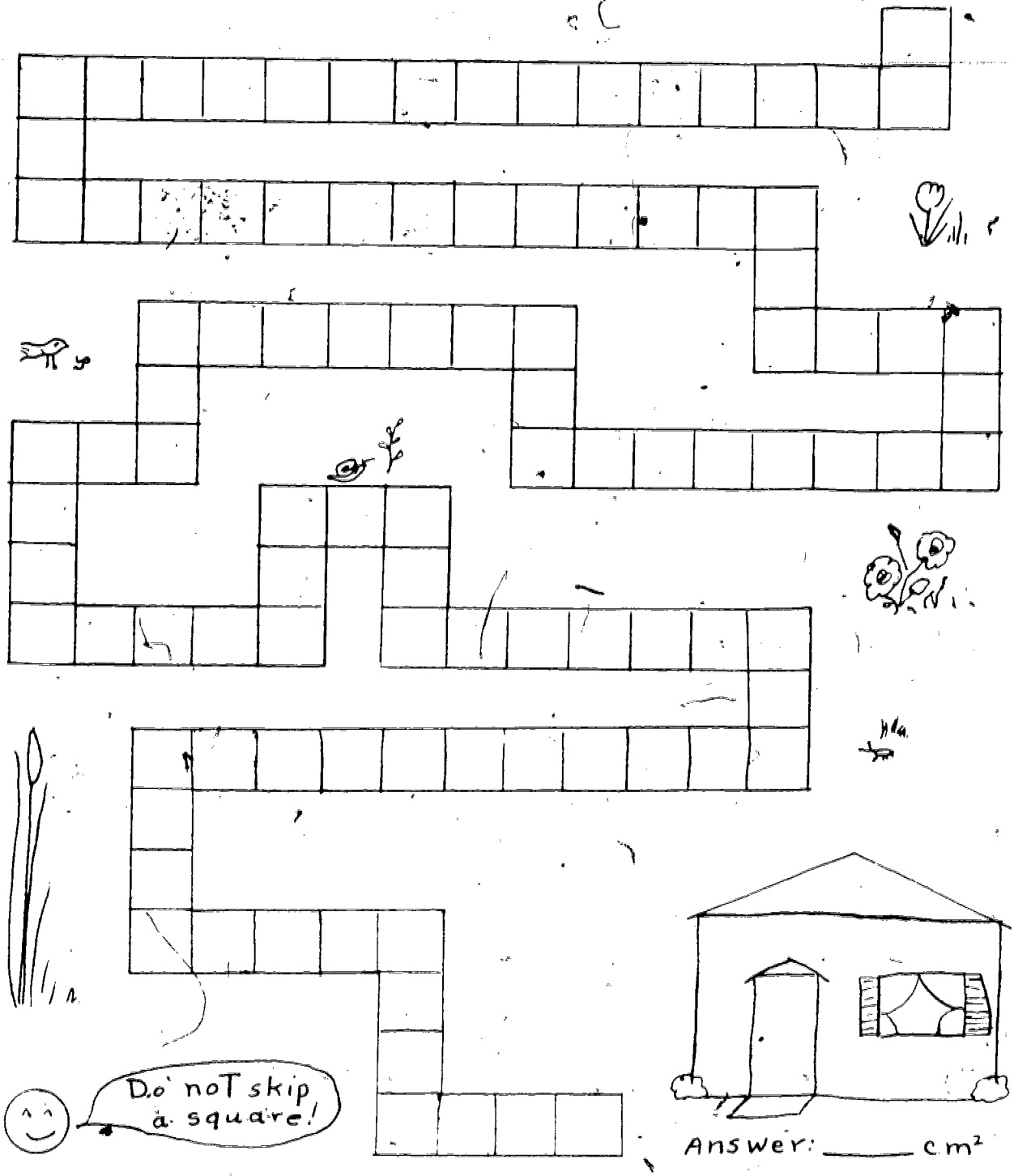
(1) Make three square meters for use in your classroom - more about this next time.
(2) Estimate the number of square meters of carpet needed for a room in your house.

NOTES:

(1) The Milli Path is a visual introduction to centimeter squares. Although second or third grades will not understand area, they can begin to associate the terms with the form.
(2) Measuring With Squares introduces the idea of mentally fitting squares into an area. Begin by drawing a square centimeter. This sheet may not be possible for a child until third or fourth grade.
(3) Just Plane Squares is a much more advanced exercise. Intermediate students may use exercises like this as a discovery route to formulas - junior high students probably should. But use of formulas should not be expected or sought until equations are introduced.

Milli is coming To your house.
Count The square centimeters
in The path she plans To Take.





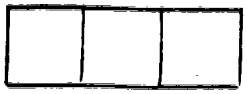
Answer: _____ cm^2

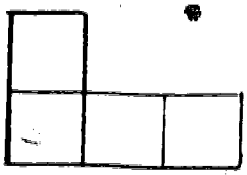
MEASURING WITH SQUARES

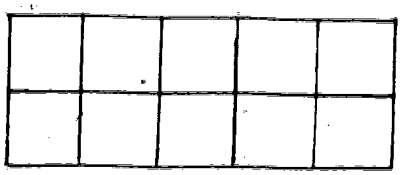
A square centimeter (cm^2) looks like this:

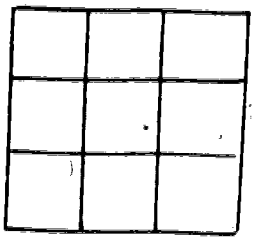
It is one centimeter long and one centimeter wide. The little ^{2} in cm^2 means the figure has two dimensions.

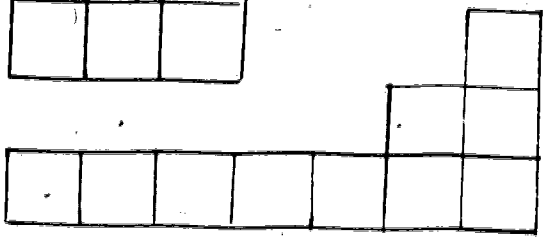
Count the squares in the figures below to find their area in square centimeters.

(1)  ___ cm^2

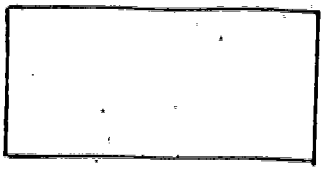
(2)  ___ cm^2

(3)  ___ ___

(4)  ___ ___

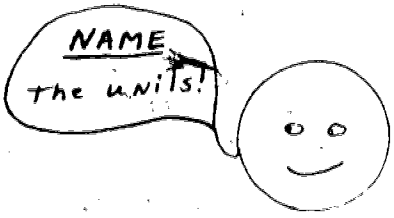
(5)  ___ ___

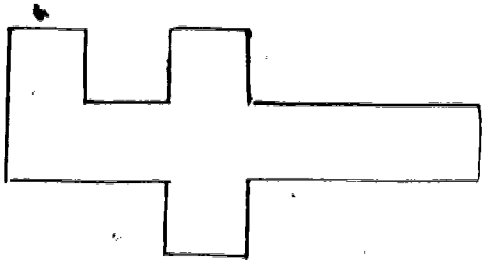
Now estimate the number of square centimeters in the figures below. Can you find a way to measure them?

(6) 

Estimate ___ ___

Measure ___ ___



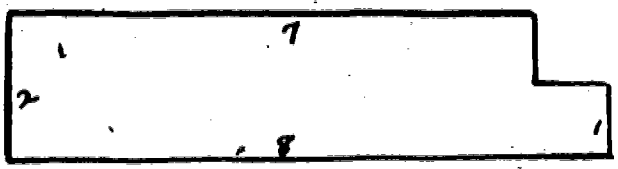
(7) 

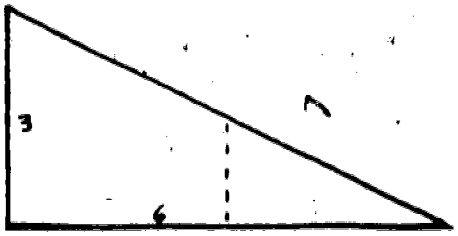
Estimate ___ ___

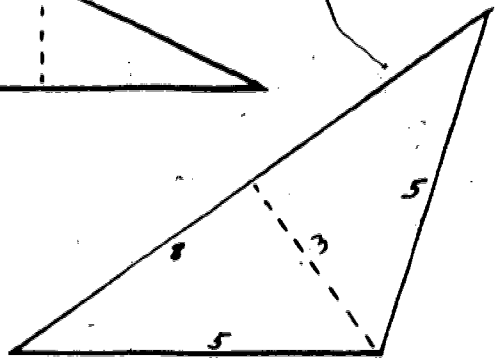
Measure ___ ___

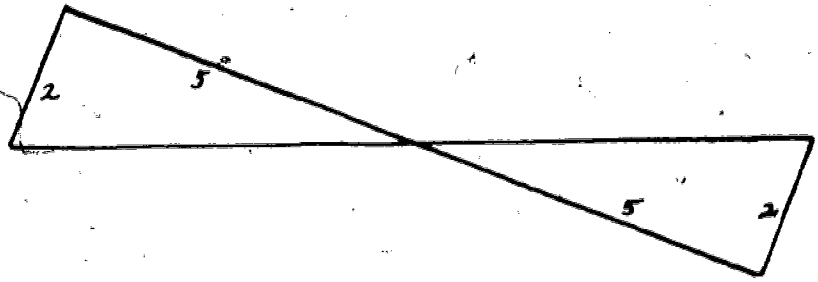
JUST PLANE SQUARES AND OTHER SHAPES

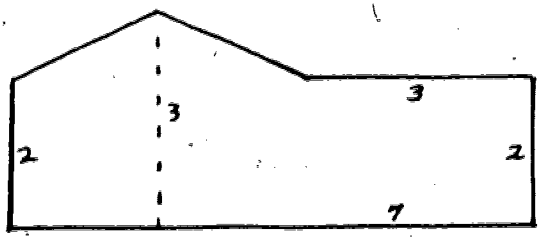
	Guess	Actual
1.		____ cm^2 ____
2.	____	____
3.	____	____
4.	____	____
5.	____	____











Use a transparent grid, or cut out the figures and place them on grid paper. Sometimes it is helpful to cut the figure into parts and rearrange them.

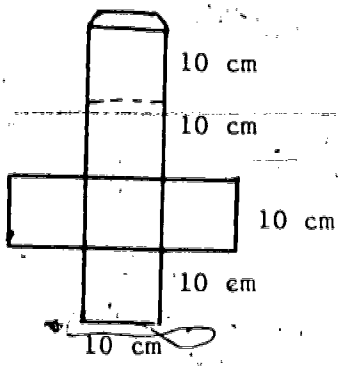
Bonus activity: On the back of this same page, see how many different shapes you can draw that have an area of twelve square centimeters and sides that are a whole number of units (centimeters) long.

TO: METRICONTACT TEACHERS VOLUME - CUBES

In Advance:

(1) Record attendance of previous session; save sheet. Prepare a new sign in sheet.

(2) If there is no blackboard in your meeting area, sketch a pattern for a dm^3 on a sheet of paper.



You Need:

(1) cm cubes
(2) Permanent ink pens - fine tip
(3) 2 cm blank cubes (wood, foam rubber, paper)
(4) String
(5) cm rulers and meter sticks
(6) Construction paper (30 x 42 cm or more)
(7) Scissors
(8) Paste or Masking tape

Suggested Activities:

(1) Complete the two worksheets using cm cubes as needed.
(2) Make a cubic decimeter and a cubic centimeter from construction paper. Show a pattern, but do not use to trace. Suggest they may want to write some metric notes on the outside.
(3) Make a cubic meter in one corner if possible, using 3 square meters, a metre stick, and string.
(4) Make two or more game cubes and try out Sumthing Else. (This is not an elementary level game!)

Assignment:

Make game cubes suitable for use in your classroom. Be sure you can play some game with your students.

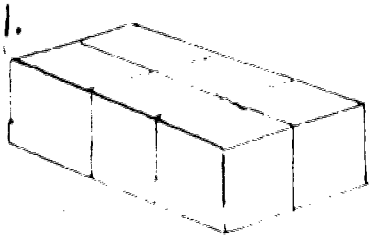
NOTES:

(1) Cubes and Other Solids emphasizes the fact that volume is expressed in terms of the number of cubes that will fill a three dimensional space. This should begin with actually fitting cubes into spaces. Elementary students can do these exercises.
(2) Building in Three Dimensions continues the idea of cubes occupying space, and relates to area by counting of squares that show. This sheet can be completed by students at intermediate level. Junior high students can generalize rules from it.
(3) Water Ways relates length, area, volume, and liquid capacity, one of the special advantages of the metric system.
(4) Learn to call these game cubes, not dice, to emphasize their shape.

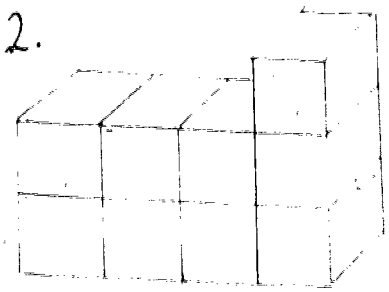
CUBES AND OTHER SOLIDS

This is a cubic centimeter. Each edge is one centimeter long. The little ^{3} in cm^3 means the figure has three dimensions: length, width, and height.

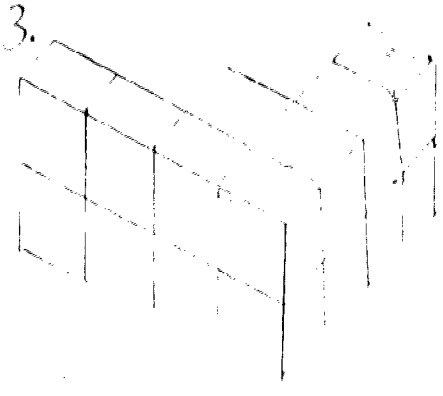
Find the volume of each of the figures below, assuming that each little cube is a cubic centimeter. Remember to count the ones you cannot see.

1. 

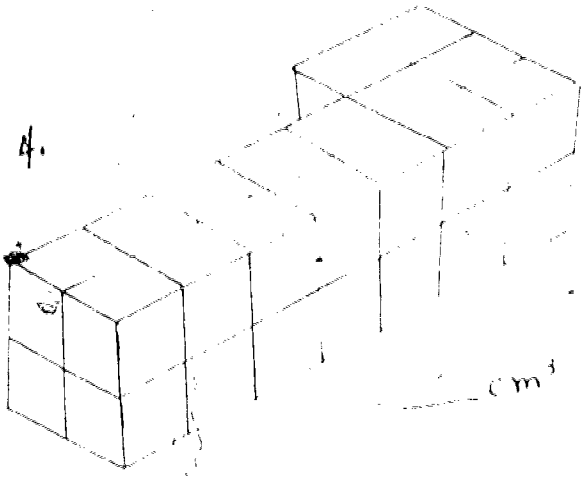
_____ cm^3

2. 

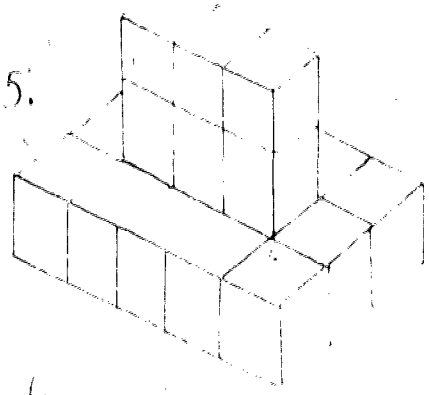
_____ cm^3

3. 

_____ cm^3

4. 

_____ cm^3

5. 

_____ cm^3

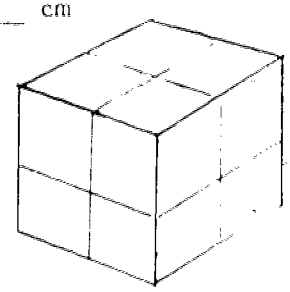
6. 

_____ cm^3

BUILDING IN THREE DIMENSIONS

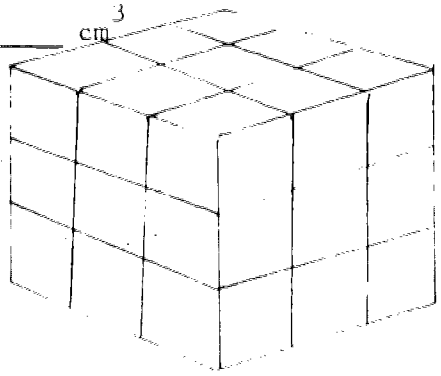
Use centimeter cubes. Build a larger cube 2 cm x 2 cm x 2 cm. Suppose that you painted the outside only with silver paint. Answer these questions.

1. How many cm cubes did you use? _____ cm cubes
2. What is the volume of the larger cube? _____ cm^3
3. What is the area painted? _____ cm^2
4. How many cm cubes are painted:
   a. on four sides? _____
   b. on three sides? _____
   c. on two sides? _____
   d. on one side? _____
   e. on no sides? _____



Now build a cube 3 cm x 3 cm x 3 cm. Suppose you painted the outside only with silver paint. Now answer these questions.

1. How many cm cubes did you use? _____ cm cubes
2. What is the volume of the large cube? _____ cm^3
3. What is the area painted? _____ cm^2
4. How many cubes are painted:
   a. on four sides? _____
   b. on three sides? _____
   c. on two sides? _____
   d. on one side? _____
   e. on no side? _____



CHALLENGE. Imagine building a 4 cm x 4 cm x 4 cm cube. Try to answer these questions as if it were painted silver on the outside only. If necessary, build the cube to check your answers.

	Guess	Checked
1. How many cm cubes did you use?	_____ cubes	_____
2. What is the volume of the large cube?	_____ cm^3	_____
3. What is the area painted?	_____ cm^2	_____
4. How many cubes are painted:		
a. on four sides?	_____	_____
b. on three sides?	_____	_____
c. on two sides?		
d. on one side?		
e. on no sides?	_____	_____

MetriCubit - The Fun Dimension

Use 2 cm cubes made of wood, plastic, foam rubber, or cardboard. Print the words or symbols with indelible ink. Make at least one full set.

Cube Number	Markings					
1.	length	volume	mass	distance	capacity	weight
2.	meter	liter	gram	m	l	g
3.	milli	centi	deci	deka	hecto	kilo
4.	m	c	d	da	h	k
5.	0.001	0.01	0.1	10	100	1000
6.	mm	cm	dm	dam	hm	km
7.	mg	cg	dg	dag	hg	kg
8.	ml	cl	dl	dal	hl	kl
9.	mm	cm	dm	mg	kg	ml
10.	cm^2	dm^2	m^2	dam^2	hm^2	km^2
11.	cm^3	dm^3	m^3	dam^3	hm^3	km^3
12.	1	2	3	4	5	6

Matching Games

Select cubes to be used on the basis of current classroom objectives; for example:

Cubes 1 and 2 for meaning of root words and their symbols
Cubes 3 and 4 for prefixes and their symbols
Cubes 3 and 5 for prefixes and their values

Use as many cubes at one time as is consistent with the level of the students. An easy scoring system is

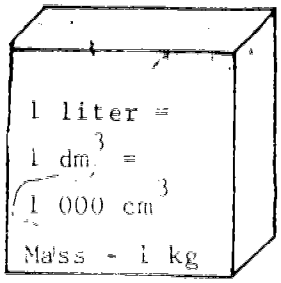
Match 2 on one throw, 2 points (or 20)
Match 3 on one throw, 3 points (or 30)
Match 4 on one throw, 4 points (or 40) etc.

Highest score wins at end of pre-set time period. Or set a point total to mark the end of a "game."

Something Else

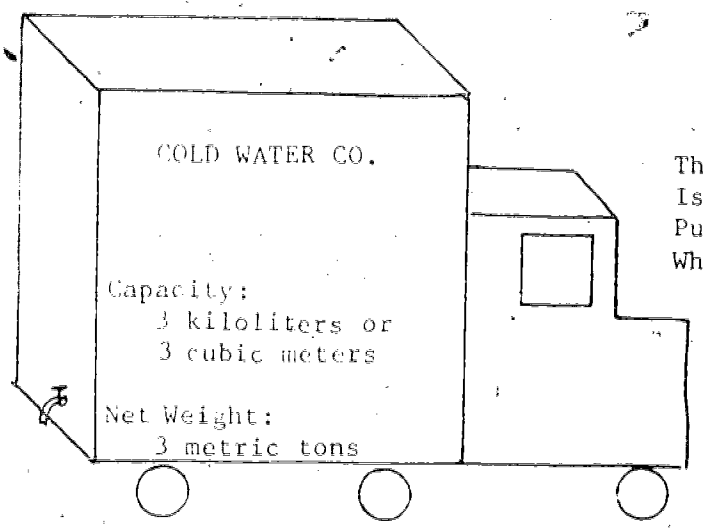
Use cubes 11 and 12. Rotate the throws, with each student recording his throw (or all throws), until each has five measurements (example $6 m^3$). Find the sum of the measurements. (Vary this by calling for largest total, smallest total, first one finished, etc.)

WATER WAYS - THE LIQUID STANDARD



I'm a cubic decimeter
But my friends just call me liter
Filled with water pure and cold
One kilogram is what I hold.

I'm a cubic centimeter
You can call me milliliter
The water in me weighs one gram
That's how very small I am.



The cubic meter, it is true
Is called a kiloliter, too.
Put water in, just let it run:
When full it weighs a metric ton!

Choose the best unit to complete these statements:

1. Bring home a _____ of milk.
2. Jack put two _____ of water in the wading pool.
3. It will take seven _____ of cement for the driveway.
4. Jane's letter weighs only twelve _____.
5. The market price for cotton is now $7,275 per _____.
6. Buy five _____ of potatoes for next week.
7. The recipe calls for sixty _____ of lemon juice.

NOTE: Drawings on this page are not to scale.

TO: METRICONTACT TEACHERS CAPACITY - LIQUIDS

In Advance:

Record attendance of previous session, save sign in sheet; prepare a new sheet.

You Need:

(1) A filmstrip on volume or capacity, if available, and projector
(2) A litre box
(3) Graduated cups or cylinders
(4) Scissors
(5) File cards (10 cm x 15 cm) or sentence strips (10 cm x 60 cm)
(6) Punch, juice, soda, lemon, ice, cups

Suggested Activities:

(1) Filmstrip, if available
(2) Look over the Measuring Liquids sheet and point out the kinds of measuring tools available in your school. Many are now on sale locally. If your school funds permit, have the punch.
(3) Work the Milli Sum or Difference exercise - stress that each answer should include the unit symbol: ex: (1) 33 ml
(4) Make at least one of the card games and play in pairs or small groups. Note that use of file cards makes them very inexpensive.

Assignment:

Are you talking about the metric system and telling someone else what you do each time? When you can "speak metric" fluently, you have mastered it.

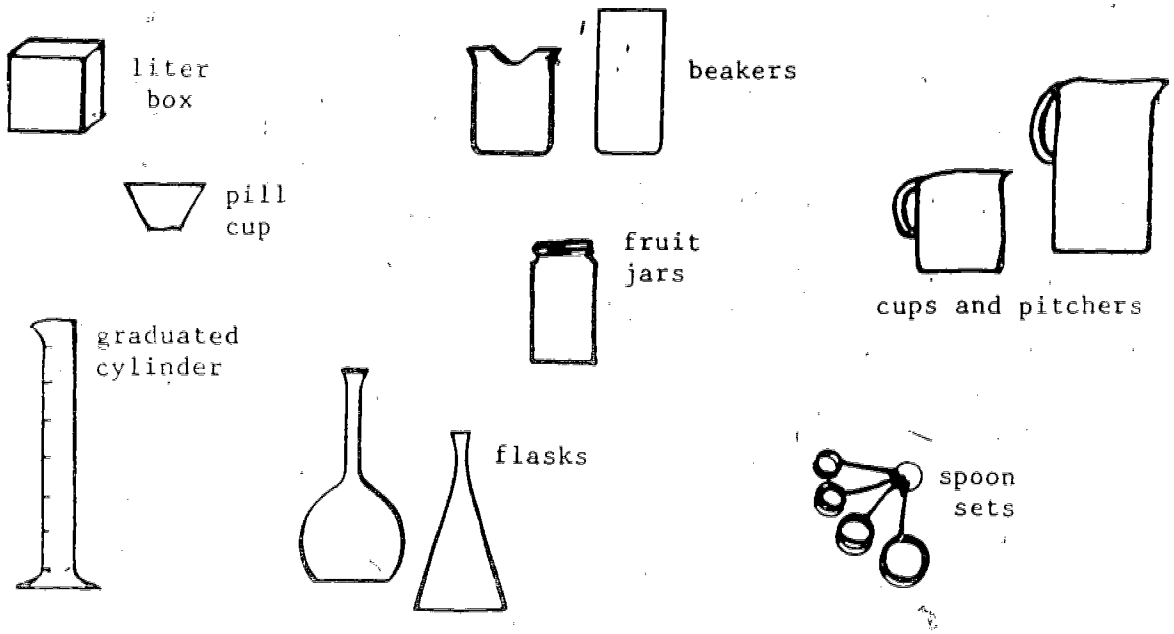
NOTES:

(1) All science exercises including liquids should be measured metrically. But for introducing the unit, why not a consumable!
(2) Milli makes drill in addition and subtraction more fun and self-checking. Finely graduated cylinders are not always available. This gives each student a chance to read a milliliter scale in units.
(3) Card games can be diversions or they can be learning tools. Properly matched to classroom goals, they have real potential for motivation and painless drill in basic relationships. They require a minimum of supervision, usually encourage the use of metric vocabulary, and all with no pages to grade afterward. But, they cannot do it all! Don't rely on them too much.

MEASURING LIQUIDS AND THINGS THAT POUR

In the metric system, the liter is the unit for measuring liquids. A liter is the capacity of a container with inside dimensions ten centimeters long, ten centimeters wide, and ten centimeters deep: 1000 cm^3. Since ten centimeters make one decimeter, the capacity could also be called a cubic decimeter: 1 dm^3. Such a container, made of plastic or cardboard, is often called a liter box.

For general use, there are many kinds of measuring cups marked in liters and milliliters (1000 ml make one liter).



Now make yourself a MetriCooler:

Take one 240 mL cup

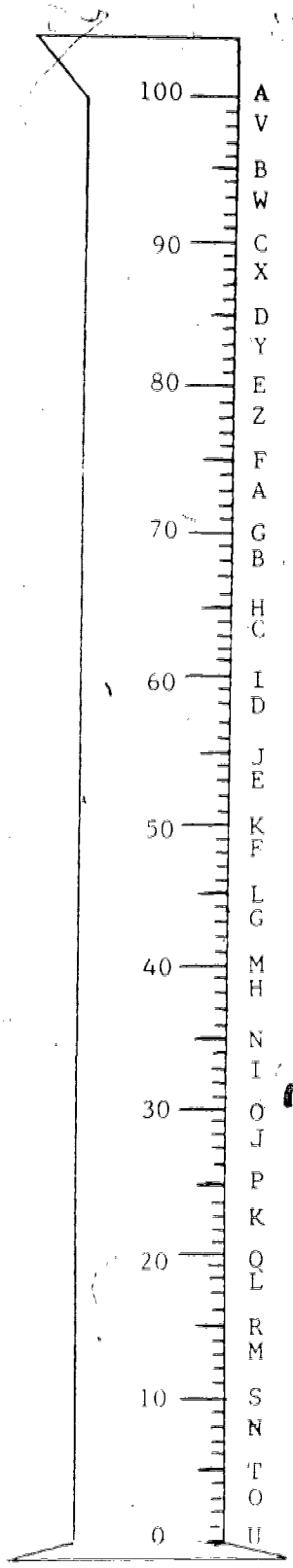
Add 60 mL crushed ice or 2 large cubes

Pour in 120 mL fruit juicy red Hawaiian Punch, chilled
45 mL cranberry juice, chilled
30 mL lemon or orange soda, chilled

Garnish with thin lemon slice. (On a hot day, use a tall glass and double the recipe!)

NOTE: For ten people, you need one each of 46 oz. Punch, 16 oz. Juice, and 12 oz. soda.

--Adapted from a recipe developed by RJR Foods home economists.



Find each sum or difference. Write the letter nearest your answer over the problem number.

(1) 12 mL + 21 mL =

(2) 82 mL - 72 mL =

(3) 22 mL + 13 mL + 5 mL =

(4) 2 cL + 63 mL =

(5) 87 mL - 42 mL =

(6) 7 mL + 6 cL + 13 mL =

(7) 9 dL - 8 dL =

(8) 104 mL - 19 mL =

(9) 3 cL + 3 mL + 2 cL =

(10) 3 cL - 15 mL =

Milli says:

"THE LITER

(1) (2) (3) (4)

(5) (6) (7) (8) (9) (10) !"

CARD SETS TO MAKE

Set A: 2 each

kg	kL	km
hg	hL	hm
dag	daL	dam
g	L	m
dg	dL	dm
cg	cL	cm
mg	mL	mm

2 wild cards - play only in runs
1 super wild - play in books or runs
Any horizontal row makes a book.
Any vertical set of four consecutive (same column) is a run.

Set AB: 1 each, Set A
1 each, Set B

Set B: 2 each

kilogram	kiloliter	kilometer
hectogram	hectoliter	hectometer
dekagram	dekaliter	dekameter
gram	liter	meter
decigram	deciliter	decimeter
centigram	centiliter	centimeter
milligram	milliliter	millimeter

Set C: 5 each

1 cm line segment	6 cm line segment
2 cm " "	7 cm " "
3 cm " "	8 cm " "
4 cm " "	9 cm " "
5 cm " "	10 cm " "

A match in this set is any combination of equal length: 2 cm and 3 cm will match 5 cm. Do not label segments. Keep a ruler handy!

Set D: 4 each

10 hm	1 km
10 dam	1 hm
10 m	1 dam
10 dm	1 m
10 cm	1 dm
10 mm	1 cm

Set E: 4 each

100 hm^2	1 km^2
100 dam^2	1 hm^2
100 m^2	1 dam^2
100 dm^2	1 m^2
100 cm^2	1 dm^2
100 mm^2	1 cm^2

Set F: 4 each

1000 hm^3	1 km^3
1000 dam^3	1 hm^3
1000 m^3	1 dam^3
1000 dm^3	1 m^3
1000 cm^3	1 dm^3
1000 mm^3	1 cm^3

Set G: 3 each

100 m	10 dam	1 hm
200 m	20 dam	2 hm
500 m	50 dam	5 hm
600 m	60 dam	6 hm

6 each: 300 m, 30 dam, 3 hm

Object: make a km

Set H: 3 each

100 mm	10 cm	1 dm
200 mm	20 cm	2 dm
500 mm	50 cm	5 dm
600 mm	60 cm	6 dm

6 each: 300 mm, 30 cm, 3 dm

Object: make a meter

Set I: 2 each

km	1000	10^3
hm	100	10^2
dam	10	10^1
m	1	10^0
dm	0.1	10^{-1}
cm	0.01	10^{-2}
mm	0.001	10^{-3}

Same play as sets A and B

Filing cards (4x6) cut into thirds make satisfactory and very inexpensive cards. Sentence strips (4x24) cut into two-inch (excuse the four-letter word!) segments make more durable ones. Colored poster board or laminated construction paper will be more attractive. Blank playing cards are available (see guide).

MetrEQUALS - a matching game for any set listed (wild cards may be omitted).
- 2 to 6 players, seated in a circle
- shuffle cards well before starting game

Deal one card at a time face down, circling around to the left until all cards are distributed. First player to the left of dealer starts the play by putting down one of his cards, face up. If the next player to the left can match it, he plays the matching card and then plays any other card from his hand, face up. Player to his left matches that one, plays one, etc. If any player cannot match the card showing, he must pass and player to his left gets the turn. First player to play all his cards is the winner.

Variation: Deal as above until each player has five cards. Deal one card in the center, face up, to be played upon. Place remainder of the deck face down to one side as a bank. Play proceeds to the left. If a player cannot match the showing card, he may draw one from the bank or pass. Note: there is no discarding, only play on the showing card.

A match may be defined as two cards with exactly the same symbols, a symbol and the word it stands for, a symbol and the related value, or two equal values, depending upon which set or combination of sets is being used.

Set AB - learning words and their symbols
Sets A,B,D,G,H - relationships between units
Set C - estimation in centimeters, visual discrimination
Set E - area relationships
Set F - volume relationships
Set I - junior high or advanced intermediates
Sets G & H - developed for underachieving sixth graders
Set A or B - as a matching game, can be played by second graders who know the alphabet.

TO: METRICONTACT TEACHERS

MASS - WEIGHT - FORCE

In Advance:

(1) Record attendance of previous session - prepare a new sheet. Save the old one.
(2) You may want to ask others to bring supplies for masses - check through your list.
(3) Call the Project Office to get copies of the Teacher Survey to use at the last session - 727-8022 - Violet Daniel. This is the post-test.

You Need:

(1) A filmstrip on mass or weight, if available, and projector
(2) Metric personal scale
(3) cm cubes - 1 gram
(4) A can of sand
(5) Some small stones of various masses
(6) Modeling clay
(7) A variety of scales, balance and spring
(8) Mass sets
(9) Coat hanger, ruler, paperclips, cups, string

Suggested Activities:

(1) Show the filmstrip.
(2) Complete Mass, a Personal Matter. See if workshop members can relate to previous times they weighed (but don't ask how many kilograms they gained!)
(3) Complete Ups and Downs sheet. It is surprising that many people do not really understand balance.
(4) Work on the remaining two sheets in small groups, changing stations so all have a chance to do each one.

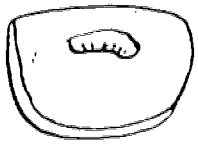
Assignment:

Review your materials and your copy of the Parent's Guide in preparation for a brief "test" next time (easy multiple choice). There is no "passing" or "failing" grade, but each one must take it to receive credit for the workshop. Read page 9 in the Parent's Guide.

Why:

The object of these sheets is to gain familiarity with the two commonly used units of mass, the kilogram and the gram. Stress that we seldom use scales except for our own weight - most items we buy are already marked and packaged, or the weighing is done by a clerk. We do need to know that the same prefixes are used as with the meter and the liter, and that the decimal works the same way. We also need to develop a feel for the gram and the kilogram, so that we can make reasonable estimates.

MASS - A Personal Matter



Guess your metric mass: ____ kilograms. (Remember, kilograms are more than twice as large as pounds, so it will take less than half as many kilograms to equal your mass.) Check your guess by using a personal scale.

Now use the personal scale to find the mass of several large objects. You can hold the object while you stand on the scale, then subtract your mass from the reading on the dial.

Object	MASS	
	Guess	Actual
1. Chair		
2. Stack of books		
3.		
4.		
5.		
6.		

Mass Has Its Ups and Downs

The balance tells you which of two things has the greater mass, because the heavier object goes down. If their mass is the same, the balance stays level.

Draw a picture to illustrate each set:

Grapes 700 g / Apples 500 g	Bone 1 kg / Dog 2 kg
Box 1 kg / Doll 1000 g	Potatoes 2 kg / Melon 1200 g

On the back of this page, draw a picture of you and your best friend on a giant size balance!

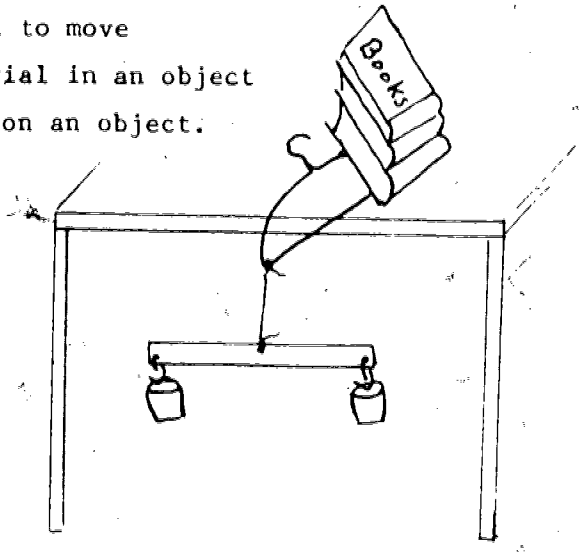
Must I Always Fall DOWN?

Some words to be used:

Force - something that causes an object to move

Mass - a measure of the amount of material in an object

Gravity - the force that the earth has on an object.



Needed:

2 magnets (alike)
A nickel
Some string
A wire coat hanger
2 large steel paper clips
2 paper cups (alike)
cm-gram cubes
A wooden ruler with holes at center and each end

Make a balance like the one shown above. (If the two ends do not hang level, add a small piece of masking tape to the higher end.)

Hold a nickel above one of the cups; turn it loose.

What happened?_____

In which direction did it fall?_____

What caused that result?_____

What happened to the cup?_____

What happened to the ruler?_____

What happened to the other cup?_____

Drop a cm cube in the other cup and see what happens. How many cubes does it take to make the ruler level again?_____

Are the nickel and the cubes the same size?_____

What is the same when the ruler is level?_____

Hold the magnet over one of the paper clips and see what happens.

Did the cup "fall" UP?_____

Would "move" be a better word for what happened?_____

Can the magnet move the cup down? How?_____

Can it move the cup sideways?_____

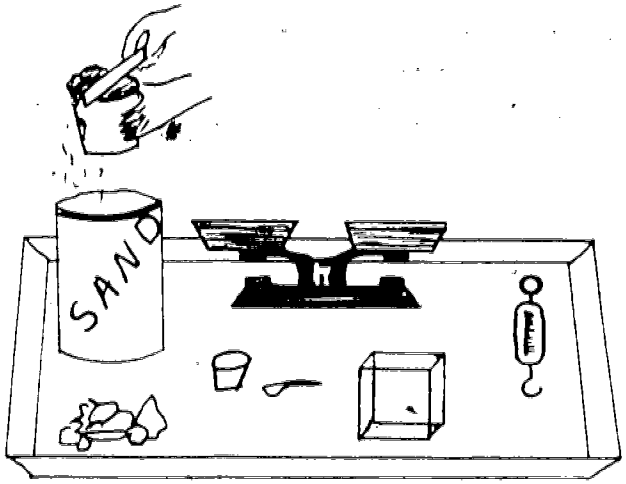
What would happen if you held a magnet on the opposite side of the cup at the same time?_____ Try out your theory.

Can you describe how to tell when two masses are equal?

Can you describe how to tell when two forces are equal?

SANDBOX METRICS - Let's Make a Mass

You will need:
A large can of clean sand
A large flat box or tray
A balance scale and a spring scale
cm cubes and large masses
cup, spoon, liter box
plastic bags and ties
modeling clay, masking tape
rock collection



Find the mass of:

(a) A cup _____g

(b) A cup filled with sand _____g

(c) A cupful of sand _____g

(d) One spoonful of sand _____g

(e) One-half cup of sand _____g

(f) Estimate number of spoonfuls in one-half cup _____

(g) Put that number of spoonfuls in the cup and check by finding the mass in grams _____g

(h) the litre box _____g

(i) one litre of sand _____g

(j) 1 000 litres of sand _____g or _____kg

Using plastic bags, make masses of 100 g, 200 g, 500 g, and 1 000 g. Tie securely, put in second bag, tie again (so a mass won't become a mess!). Remember to include both bags when you check the mass.

Now rock along -- with a spring scale.

(a) Find the weight of a collection of five stones _____g.

(b) Using the balance scale, put the stones in order from lightest to heaviest. Use masking tape to label them. Find the mass of each, add, and compare with (a). If there is a difference, see if you can determine the cause. Should weight and mass be equal? _____

(c) Use modeling clay to made a mass that you think is equal to that of each rock. Check on the balance scale. Were you close? _____

Make a set of small masses from modeling clay (10 g, 20 g, 50 g). Could you use the rocks as masses? _____ What are the problems?

TO: METRICONTACT TEACHERS VOCABULARY - FORM - SYMBOLS

In Advance:

(1) Record attendance from previous session and prepare a new sign in sheet with date. Keep all these.
(2) Ask teachers to bring L'Eggs or other small containers
(3) Be sure you have on hand Teacher Survey forms.
(4) Be sure you have on hand Certificate Renewal forms.

You Need:

(1) A list of measurement terms (bottom of page)
(2) Construction paper, tagboard, or file cards
(3) Felt pens or magic markers
(4) Scissors

Suggested Activities:

(1) Complete any Certificate Renewal forms furnished by Dr. Sandefur's office (Return these to him.)
(2) Complete Teacher Survey forms to be returned to project office.
(3) Work on the activity sheets or make Scrambled Eggs.

Assignment:

Workshop leader - complete attendance records - get all forms sent in.

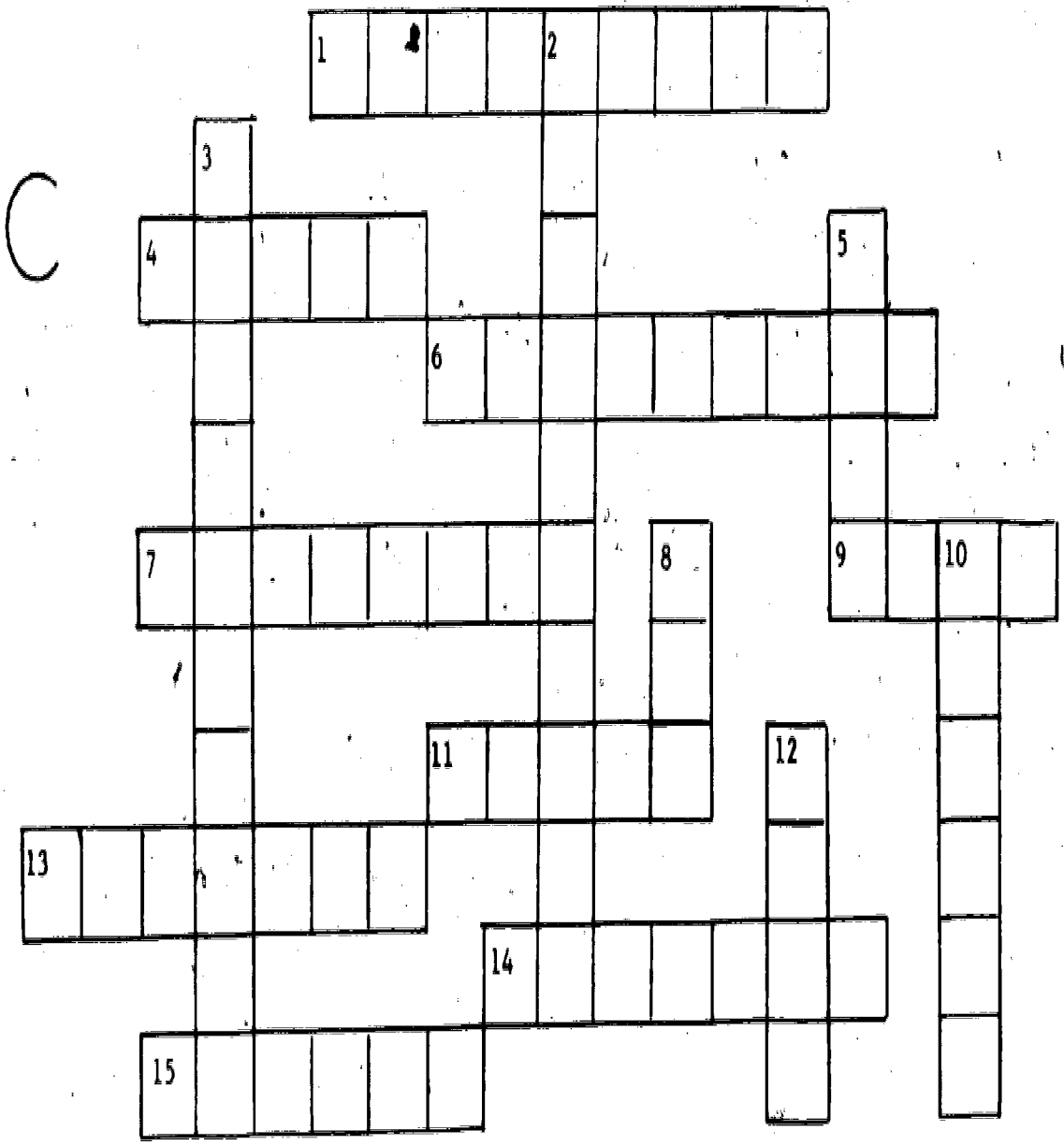
Notes:

These puzzles will require attention to what units measure familiar things and how the names are spelled. Scrambled Eggs (one word at a time) is an activity suitable at many grade levels. Scrambled Words illustrates use of a few easy words for intermediate level students.

Some Measurement Words:

day	meter	celsius	milligram
are	liter	kilowatt	centigram
cent	ton	decigram	hectogram
dime	dollar	dekagram	millimeter
hour	second	kilogram	centimeter
week	minute	decimeter	hectometer
year	decade	dekameter	millliliter
gram	degree	kilometer	centiliter
watt	century	deciliter	hectoliter
month	hectare	dekaliter	micrometer
		kiloliter	metric ton

METRIC CROSS



ACROSS

1. Ten ___s = one metre
4. Base measure of length
6. A long distance
7. Unit for your mass
9. What a balance scale measures
11. You may buy milk by the ___
13. Measure land by the ___
14. A new name for Centigrade
15. Ten years

DOWN

2. 1000 ___s make a metre
3. 10 millimetres
5. A small mass
8. Half a tennis court is about an ___
10. Base unit for time
12. 60 minutes

NOTE: This puzzle uses RE spelling throughout.

Find the hidden measurement words.

S	E	C	O	N	D	B	M	O	N	T	H	C
D	K	E	F	T	I	C	E	G	S	R	Q	J
M	I	L	L	I	M	E	T	R	E	L	N	P
D	L	S	H	M	E	N	R	A	D	I	A	N
O	O	I	C	E	N	T	I	M	E	T	R	E
L	G	U	E	T	D	E	C	I	G	R	A	M
L	R	S	N	U	M	A	S	S	U	E	M	T
A	A	V	T	H	E	C	T	O	G	R	A	M
R	M	S	U	C	A	N	D	E	L	A	V	I
D	E	G	R	E	E	H	J	H	W	X	A	N
A	T	D	Y	N	E	W	T	O	N	Y	M	U
Y	R	E	R	D	F	E	K	U	Z	A	P	T
H	E	C	T	A	R	E	L	R	R	S	E	E
K	P	I	R	D	E	K	A	M	E	T	R	E
E	N	M	I	L	L	I	L	I	T	R	E	W
L	D	E	C	A	D	E	O	M	O	L	E	A
V	M	T	K	R	C	G	M	C	N	J	X	T
I	L	R	Y	E	A	R	B	O	N	W	Z	T
N	K	E	Q	K	I	L	O	M	E	T	R	E

NOTE: This puzzle uses RE spelling throughout.

Winston-Salem/Forsyth Metric Education Project - ESEA Title III

SCRAMBLED EGGS

The letters for these measurement words were cut out, and each was stored in a L'eggs egg. When the eggs were opened, the words were all mixed up. See how many you can put into the right order.

1. NOTNE
2. MARG
3. METTERNICE
4. LARLIMMIG
5. LEMMIRELTI
6. TRILE
7. CREEMITED
8. NECT
9. RILTILLIME
10. LUCESSI
11. KIRMALOG
12. AREY
13. DREEGE
14. LAROLD
15. TOMETREECH
16. TAWT
17. MIKETROLE
18. CHEARTE
19. NUTIME
20. CURTNEY
21. COSDEN
22. REA
23. TWALOKIT
24. TENNOW
25. TREEM
26. RATEMEDEK
27. TRILOLIKE
28. MEDI
29. CADEDE
30. RUHO

SCRAMBLED WORDS.

These words are all mixed up. See if you can put the letters in the right order to make metric words.

1. MARG _____
2. TREEM _____
3. METTERNICE _____
4. TRILE _____
5. MIKETROLE _____
6. KIRMALOG _____
7. LUCESSI _____