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ABSTRACT

The material-tool approach of the statewide program, Technology for Children, for grades kindergarten through six (K-6) is described in this teaching guide. This approach, which encourages a workshop-laboratory-classroom learning environment, is integrated among subject areas and is thematic in nature. The program operates under three goals: (1) To aid in developing self-awareness and responsibility, (2) to aid in developing an understanding of technology and the world-of-work, and (3) to enhance the learning process. Interest learning, children-tools and learning, classroom organization, and developing a safety philosophy are discussed. Ideas, suggestions, and references are provided for these sections. The guide contains 22 interest areas, ranging from automation to tool making. Each interest area describes an idea/problem, procedures for examining the idea/problem, materials and equipment need, and follow-up. To supplement the guide, a list of materials and sources (available at minimal cost to the teacher) is provided, as well as a list of suggested resources for material and equipment. A follow-up survey sheet for the guide is included. (TA)

Getting Started in the Classroom

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TABLE OF CONTENTS

INTRODUCTION

Technology for Children is an elementary school K-6 statewide program which reflects a view of childhood. It draws upon technology to enlarge and alter the learning options for children. Begun in 1966, it introduces a less-formal, material-tool oriented approach to learning. The approach is integrated among subject areas and thematic in nature. It encourages a workshop-laboratory-classroom learning environment in which learning is made personal.

Three goals have helped guide the program. They are: (1) to aid each child to develop a greater self-awareness and responsibility for his own learning, (2) to aid each child to develop a greater understanding of technology and the world-of-work, and (3) to enhance the learning process.

These goals are reflected in this idea guide which has been developed to help you the teacher initiate Technology for Children. The ideas and activities suggest starting points to help you and the children plan, arrange and sustain the learning environment. Great profit comes from developing ideas. One purpose here is to help you generate conditions in which children can be idea developers with ideas like those suggested here and their own. As an idea guide, it is more process than content oriented. Thinking, planning, questioning, inventing and sharing work are encouraged.

A great variety of materials is essential to initiate and sustain such an effort. Some sources for materials are identified near the end of this publication. Materials and actions which are open-ended and which suggest many paths to learning are preferred.

Finally, a follow-up survey sheet is included. After a reasonable period of use of this guide, the reflections of you and your children will help us improve the guide. We look forward to your responses.

INTEREST-LEARNING CENTERS

IDEAS AND SUGGESTIONS

What does a Technology for Children classroom look like? Walk into one* and see. Directly before us are five children building a store. To their left are several children building scenery for their own television production. As we move near the sink we see four children developing film and making prints to illustrate a book they are preparing. One group has gathered on the rug to discuss a money system to use with their own store, bank and manufacturing business. Near the windows, two girls compare a leaf identification book with a collection they have gathered. Several children select task cards from an open display and move to work at a table with many math and measuring tools and aids. Near them, three boys drop balls of various kinds and measure the height of the bounce. One of them records the results on a clipboard. Several children team up to read to each other. Two girls and two boys prepare a colorful chart to show the results of an endurance test several children just completed. Two girls construct vehicles from a mechanical building set while two boys prepare a recipe for a new cookie idea. The teacher listens to one boy read from a newspaper as they sit inside an open geodesic dome. A girl and boy work at a typewriter and duplicator on a table preparing this week's edition of the class newspaper.

The room itself abounds with examples of children's work: paintings, drawings, poetry, graphs, short stories, displays of different types of tools, clothing and products, models and natural material collections of all kinds as well as neat, colorful arrangements of flowers, ceramic pieces and wood sculptures. The room is colorful, light, airy and fresh.

We see and we learn that some materials and activities are arranged by common elements or attributes into areas or centers in the room. It is to the planning and organization of these that we turn our focus.

Less formal teachers like this one, as well as writers on the subject, suggest several ideas and guides for organizing this kind of learning climate. These ideas reflect a point of view and help inform a way of thinking about and working with children. The ideas suggest that the less formal classroom with an interest centered-thematic approach is a natural way to initiate and support a child's way of learning. Areas or centers are arranged and used in ways that support and extend learning. The classroom becomes a decentralized workshop-learning laboratory. Several assumptions underlie this style and are accepted by those who work this way. Let us look at nine of these:

1. Most children naturally want to explore, to question, to experiment, to find out, and will do so productively if given the supporting conditions.
2. Most children learn best from first-hand experience where there is a transaction among materials, situations, ideas and people with opportunities to follow through on interests.
3. Learning is likely to be more productive and lasting if considerable choice is available and felt by a learner in what, when and how he learns.
4. Learning often naturally cuts across separate subjects or disciplines and develops in an integrated thematic manner.
5. Productive learning often best begins with spontaneous interest in the immediate environment if it is richly and diversely provisioned

* A composite picture

with appropriate materials.
6. Children have individual rates and styles of learning anything.
7. Self-respect, individuality, integrity and responsibility as integral parts of freedom are fostered in an atmosphere of choice.
8. The teacher creates and maintains the conditions, tone and work pattern and encourages and supports each child's learning effort.
9. "The more active the classroom becomes, the more usefully can adults be engaged in helping children, and the more self-instructional material will be required." (3)(6)(8)(15)(18)

The support centers contain things and guides that are largely self-directing. They are located on a table, a wall, floor or corner or a combination of these. For example, two flat desks with a long plywood surface between them make an inexpensive work or display area. A rug remmant on a raised platform presents an inviting place to read. Cooking utensils and recipes on a pegboard behind a table invite children to this experience. A counter or stage will alternately be a puppet theatre, store, bank, radio station or post office. No formula will help establish or maintain these. Your own belief system and style of operating with children will determine what you do and how you work. Furthermore, the nature of the work at hand will often suggest its own best location within the possibilities of the classroom.

As you observe the children, learn from them and consider the goals for your work together, the manner of grouping will evolve. Whole group instruction or sharing is appropriate at times. Small group work seems to serve other purposes. Independent work contributes its own special values. The relative importance and timing given to these will determine the use of the total learning space. Total class or group participation in such activities as music, physical education, class meetings, oral reading by adults, and film viewing is often economical and efficient. On the other hand, reading, writing, listening to tapes or records, constructing, experimenting, counting and measuring, planting seeds, completing activity sheets or cards, observing a new animal, recording results of work, greeting a visitor, painting, modeling or contemplating may all be occurring individually and simultaneously in a classroom.

Interest-learning centers are typically set up to reflect:

1. A curriculum area: math, science, language arts, social studies, etc.
2. An expressed interest of one or more children: money, models and stories about space exploration, sporting events, animals, etc.
3. Manipulative material things likely to engage children and lead somewhere: batteries and electrical devices and materials, construction sets and materials, microscopes and insects, measuring and calculating materials and devices, photographic materials, math materials and problems, writing materials of all kinds, games, etc.
4. Commercial and teacher prepared questions, problems and guides
5. The developmental level, capacity and character of the children

The teaching styles and strategies called upon when working this way are different than those for whole class or group work. So, if this is a new way to work with children, it is recommended that movement to operating this way be a gradual process. (A large and growing body of literature exists on this approach

and provides a base of thought and practice upon which this process may grow.) A suggested successful way to begin is to set up one or two areas at a time with materials, apparatus and guides. Then invite a few to work at one time while others do group work. Gradually set up more centers as they can be comfortably managed by all. As the children learn to manage their own time and efforts independently and responsibly, a gradual transformation occurs. The choice and option on style are not irrevocable or fixed, but rather, dynamic, flexible and determined by your own belief system, the children, possibilities in the setting and the support system.

Materials selection is one crucial consideration this way of operating reveals. (2)(5)(6)(9)(13)(15) A general suggestion is to select materials that reflect the goals for the group and that are likely to engage children and lead in several directions. Also, think of learning materials in the broadest possible sense. Select them on the basis of their match (10)(16) between the present stage of development and the next steps which will engage and extend learning. This is no easy task! It requires observation, records, knowledge and insight into each individual's learning style and levels of development along its many lines, a large growing repertoire of competencies, and multiple teaching strategies.

Another consideration in this style of teaching is the awareness required of individuals. In a setting where a child is involved in actively confronting and solving problems, physically moving about, constructing, investigating, finding out, exploring, questioning, talking, reading, arguing a point and listening to another, a range of information about him is available. How he responds, what excites or depresses him, what his own paths to learning look like, what his special

abilities are, what he takes pride in, how he tackles a problem, what he questions and what engages him, for example, now have the likelihood of becoming more visible. Information may now be gathered to include:

- examples of a child's work in all its forms
- anecdotal records and jottings on each child
- sociograms
- pupil logs or journals
- problem folders
- audio records, cassette and video tapes of each child

Each of these are particularistic aids and signals in a developing, unfolding process. And each assumes its own importance in an activity oriented program.

Let us look at four ideas which are useful in all phases of work.

1. THE IDEA SUNBURST

An idea sunburst is an initiating or planning device and technique for any piece of work. It is a schematic planning guide and framework for any topic or interest. Likewise, it is a scheme which serves to draw out all pupil view on a topic. It is similiar to a map, curriculum tree, and flow diagram. Used in a group, it can generate a productive social influence.

To make one, select a large writing surface. Think about a topic or interest. Select one of several key words or phrases. Write these near the center or at several points on the surface. Now, in a free-association way, think about and list all the ideas these central words or phrases suggest. And, add each idea suggested by each previcus idea.

INTEREST-LEARNING CENTERS

IDEAS AND SUGGESTIONS

Write these as single words, short phrases or diagrams. Tie each idea with a line to show how it grew. Guiding questions from the central word or phrase or several key words or phrases include:

"What does it make you think of?"
"What does it suggest?"
"What next logically?"
"First this, and then this and then. . ."
"And. . ."

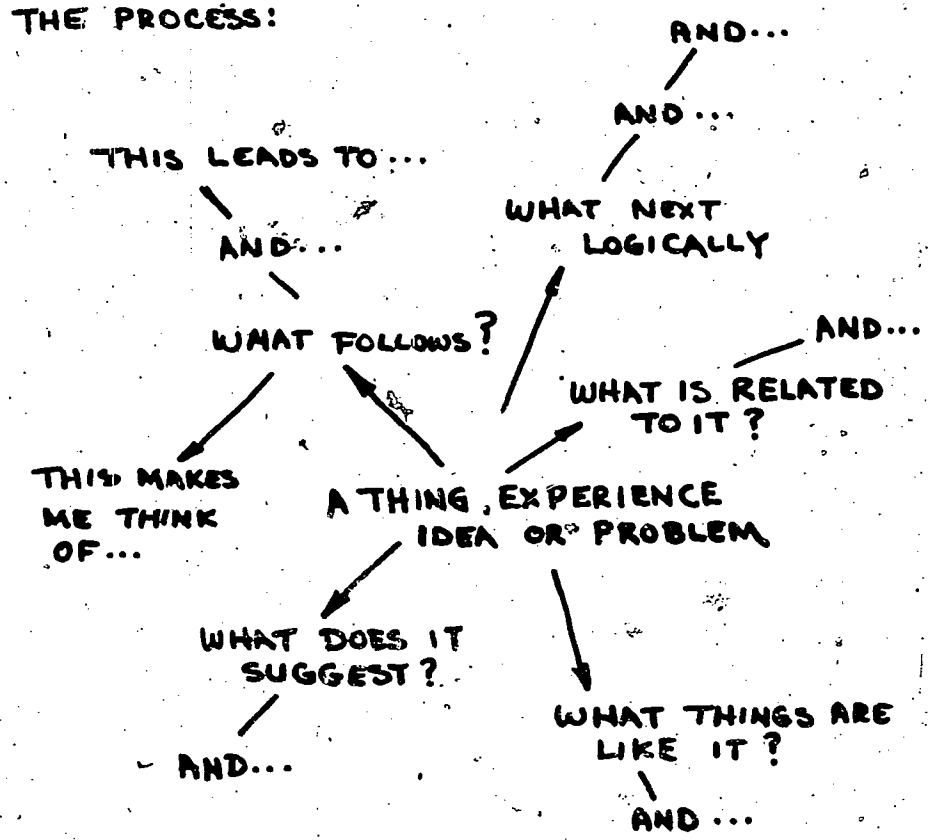
Try for inclusiveness in developing an idea sunburst. List every idea that comes to you. As a piece of work develops, one idea or problem will suggest other ideas and new problems. Several trials will be necessary to draft a sunburst. It is used in the following ways:

a. By the teacher alone before physically setting up a center to suggest a direction or directions for work.
b. By a team of teachers in planning mutual or shared work with children.
c. By teacher and children to help think about and plan what work might occur in their living together.
d. By teacher and children after a piece of work has been undertaken to see, at a glance, where it is moving.
e. By a pair or team of teachers after a period of work to see progress and to alter the next steps in planning.
f. By teacher and children to record all work accomplished.

Note: It will be useful to compare the effects of the above processes on individual and group problem solving abilities.

There might be a number of idea sunbursts developed simultaneously reflecting the several areas of work underway at any time.

THE PROCESS:



* SEE PAGE 79 FOR A SPECIFIC EXAMPLE

SOME T4C TEACHER COMMENTS ON IDEA SUNBURSTS:

"The sunburst seems to put together all the attitudes, appreciations, skills, and knowledge of a particular object or area of work. It is an aid to teachers for long-range planning and direction and also a direction for children who wish further exploration of a particular area of interest." - 6th Grade Teacher

"The Idea Sunburst provides an efficient way to direct the development of an interest center. It can also show how the center actually functioned by recording the actual directions taken as a result of the work." - 1st Grade Teacher

"It gives children a chance to find interest under an area they feel they know nothing about and expand it." - 5th and 6th Grade Teacher

"Once the students have become accustomed to using these, they can make their own. This provides skills in thinking, language arts, reading and whatever subject the problem concerns. The sunburst also shows how a student can follow a general concept in many directions and not be regimented to one particular idea." 5th Grade Teacher

"The child is presented with a problem or activity and soon begins to think in broad terms as to the many avenues he may explore, the problems he confronts and solutions he came up with. His problems and solutions may lead another to investigate." - 3rd Grade Teacher

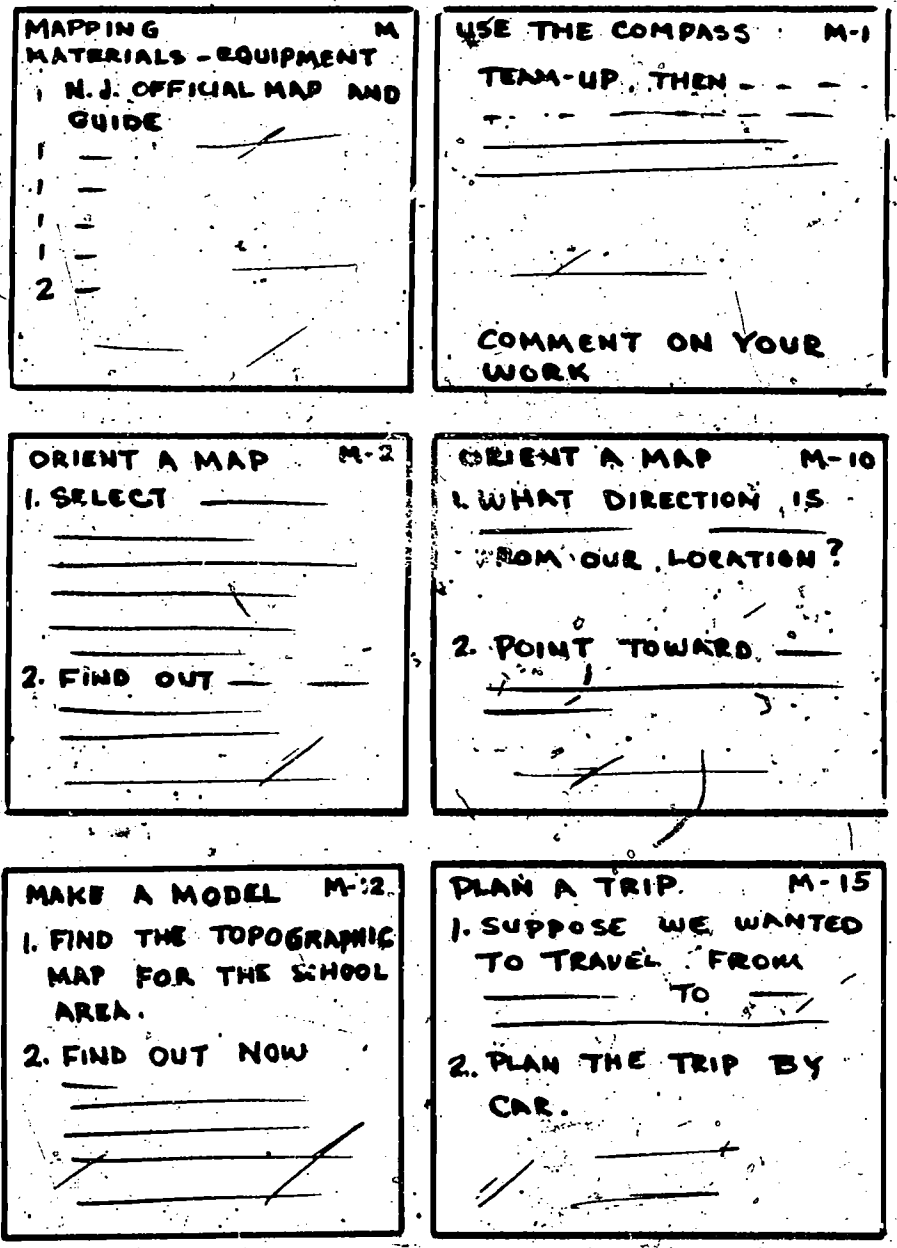
2. PROBLEM, IDEA OR TASK CARDS

As a way to help externally guide work; cards with problems, ideas of things to find out or to do, questions to answer, experiments to perform and materials and equipment needed are located where suitable at interest-learning centers. These could be both commercial - teacher selected, and teacher and child prepared - the latter being most preferred by many teachers. They are mainly self-directing guides to investigation and work which provide many starting points into a piece of work.

Cards requiring a sequence are lettered and numbered, i.e., W-1, W-2, W-3, etc., on WEATHER or A-1, A-2, etc., on ASTRONAUTS or a similiar scheme. And, they may be coded in terms of difficulty or challenge by color or symbol.

As children record their work in logs, folders, journals, or notebooks, the number-letter scheme and a date for each entry helps record and show accomplishments. Both assigned work and self-chosen tasks are guided in this way.

Several important points about this scheme for individual work should be noted. Cards are best prepared in a sequence with only a few questions, problems or tasks on each. Pacing and the "problem of the match" (10) can be accommodated with teacher prepared questions and pictorial cards. Cards should serve children. Every child need not begin at card A or card 1. Some cards may ask questions. Some cards may pose problems, include drawings or suggest projects. Some may have a sequence of steps. Some cards may be prepared by the children. It is a scheme that is flexible and adaptive to the children and the setting.



SOME T4C TEACHER COMMENTS ON PROBLEM CARDS

"Problem cards can be another way of stimulating interest and almost daring a child to pursue the project to greater lengths. I also feel that the problem or work cards should contain questions that arise from curiosity on the part of the children."
5th Grade Teacher

"Problem cards are very similar to the folders in function. It would be very profitable to have the children try to make up their own problem cards."
6th Grade Teacher

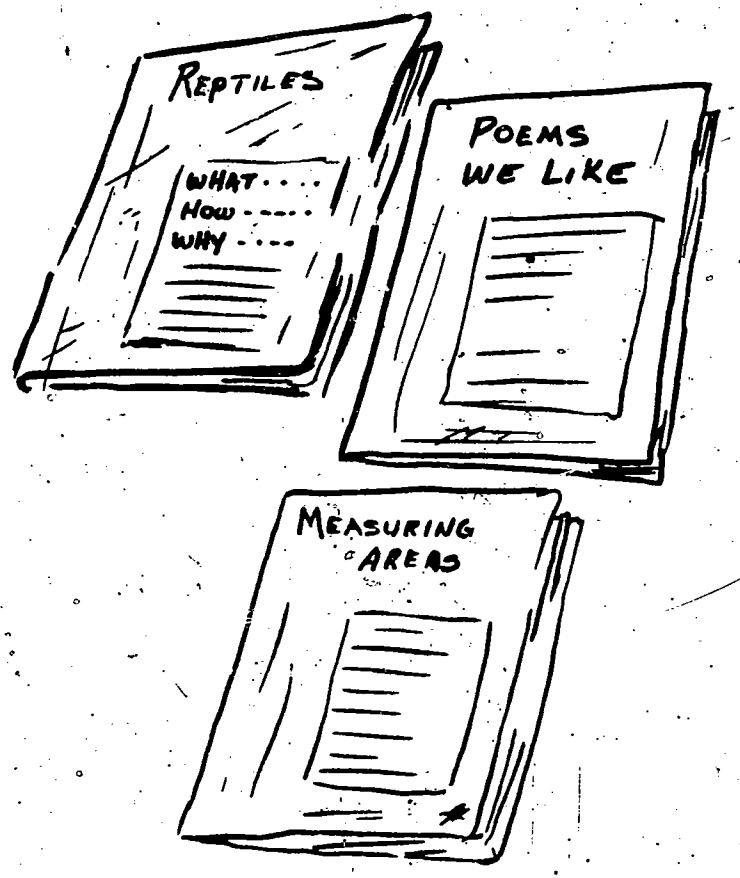
"Children could keep their own record of work by recording work accomplished each day."
2nd Grade Teacher

3. INTEREST-PROBLEM FOLDERS

Interest-problem folders are large-page, colorful booklets with children's questions on a specific thing or topic printed on the cover. As questions, work and problems develop, the teacher or child lists on the cover, several questions raised about the topic. Children are then invited to contribute to the folder in any way they choose. They can help answer questions or make contributions through drawings, written stories, fact sheets, cutout articles or pictures, descriptions and results of experiments or projects. Those who raised questions will be finding their own answers. New problems and questions will undoubtedly generate as any piece of work develops.

Many interest-problem folders in process at any time invite involvement and finding out. One or two children or a team may be responsible for folders in any particular area. Or, each child may develop his

own. Children who work individually or collaborate will show this in a folder. After a piece of work is completed, it serves as a record of accomplishment and a resource for other children. Such a scheme is used by one teacher (7) who assigns a Dewey Decimal System number to each completed folder and places it and a card in the school library for future reference by other child-researcher-authors.



SOME T4C TEACHER COMMENTS ON PROBLEM FOLDERS

"Problem folders give children a sense of responsibility and inventiveness of working on their own; of accomplishing results thru their own efforts. Teaching a child to find out information or concepts on his own is more valuable than all the facts in the world." - 6th Grade Teacher

"The problem folder is made up by the child. In it he lists what he's discovered at this center and what he can't solve. This problem is then added to the problem cards or discussed with everyone in the class and solved that way." - 2nd Grade Teacher

4. INDIVIDUAL LANGUAGE CASSETT TAPE RECORD

The cassette tape recorder is a useful tool to help keep a record of each child's language development. One cassette recorder serves about 8 or 10 children without chaos. Each child has his own 90 minute cassette tape. On it he records his own reading or a discussion for 2 to 5 minutes every 2 or 3 weeks or more often. Each child reads, discusses his work, describes an interesting experience or interviews another child on his work.

The resulting individual cassette record would serve:

a. As an accumulative audio record of language progress and developing interests and thinking
b. As a check and record of language
c. As an audio record for the following teacher(s)
d. As a condensed sampling of work for parent conferences
e. As an incentive to read and speak well

Ideas and Suggestions

Other ideas on developing and supporting this approach may be found in the following.

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It's easy to observe the high interest children have
ı tools, to see the light that shines from their faces as
ıey work with tools. The joy in being a cause is radiant.
ɜt us look at an example.

Five year old Kevin is working with his father, twin
ister Susan and younger brother John in their garage on
sunny Spring saturday. Kevin has a claw hammer, saw,
ɔme nails and wood. He is intently building something
ı the garage floor. When his father asks what he is
ıking, he answers:

"I don't know, I haven't finished it yet!"

As he cuts and assembles the wood, his sister Susan
busy collecting the spiral wood curls that fall to
ıe floor as father planes the edge of the tight fitting
ıarage door. With a little tape, she makes a toupee,
iece-by-piece for her favorite, otherwise bald, doll.

Meanwhile, two year old John intently cranks an
ɡg-beater inside an empty pan he has borrowed from the
itchen. When others in the family work with tools,
ɔhn often selects these because he can reach them and
ɜcause he can make a special noise with them.

This early interest in tools and in what they can
ɔ is a natural part of growing for these children.
imiliarly, the sheer fascination in watching a skilled
ɜrson use tools is apparent in most children. However,
ıe opportunity for most children to use a range of tools
at once an inspiration and novelty. Unsupported or
ɡnored, this early interest too soon shrivels and becomes
ıother lost opportunity. But given support, this interest
ın grow into exciting and rewarding competencies. Let
look then, at ways to extend and capitalize on this
ırly keen interest in tools.

One way to do this is simply to make a great variety
tools a regular part of the day-to-day experiences of
children. The actual use of tools in creating with authentic materials and solving real problems is a genuine starting point in extending tool interest and developing competencies, knowledge and skills. But this presents both opportunities and problems in elementary schools. The Technology for Children program, through institutes, workshops and college courses helps elementary school teachers gain, among other things, knowledge and competencies with common hand tools. Teachers, in turn, extend wider tool experiences to children as part of the teaching style. From these experiences, a new range of learning opportunities opens to children. This is a direct approach and meets with high interest and success. One possible next step is to take a closer look at tools. Tools not only extend human capacities, but also may serve as a vehicle, theme or thread to extend integrated learning. Here are three ideas that will help do this:

1. Make a tool.

   This experience is suggested later in this publication. It has many possible directions. One of these is tool definition. What is a tool? How does it help us? How does it affect the work we do? When does just plain material become a tool? What is done to materials to form a tool? How are tools different from other objects? Make a tool and find out.

2. Classify tools.

   When we classify things we typically look for common attributes. A trial scheme to do this is outlined here as a place to begin. This may be developed throughout the year and be integrated with many other topics. Seek out all the tools possible. Use pictures, diagrams,

tools or accounts of tools of older residents and real examples if at all possible. Some models may be developed from pictures when the real tools are not available. Pictorial charts, drawings and displays are also helpful. This work then naturally leads to questions about similiarities and differences in tools. Grouping tools by some common attributes is a way to develop these. The problem is to find examples that possess these attributes. Here is a tentative but workable set of attributes with two different examples:

A. Action or Purpose of the tool:
   1. Aid the senses or capacities - Telescope, lever
   2. Compare or gauge material - Ruler, measuring spoon
   3. Guide or steady the body or other tool - Spirit level, plumb bob
   4. Change the contour of material - Rolling pin, lathe
   5. Hold or bind material - Vise, stapler, magnet
   6. Add to or mark material - Pencil, scriber
   7. Remove or separate material - Axe, saw, file, knife
   8. Radiate energy - Flashlight, soldering gun
   9. Rearrange material - mold, sifter
   10. Record, copy or store information - Calculator, calendar, camera
   11. Change material internally - kiln, oven
   12. Pound material - Hammer, drumstick
   13. Move or convey material - Atomizer, vacuum cleaner
   14. Transform energy - thermostat, battery, hydraulic jack

B. What is acted upon by the tool:
   1. Paper
   2. Wood
   3. Plastic
   4. Metal
   5. Earth-mineral
   6. Textile
   7. Water
   8. Food
   9. Plant
   10. Animal
   11. People
   12. Information

C. Power required to control the tool:
   1. Hand
   2. Foot
   3. Wind-air
   4. Animal
   5. Water
   6. Internal Combustion engine
   7. Electricity
   8. Solar

EXAMPLE 1. Begin with tools and seek common attributes:

1. Hand Scissors

A_7 B_1 B_3 B_4 B_7 C_1

2. 12" Wood Ruler

A_2 B_1-B_{11} C_1

3. Wooden Pencil

A_6 B_1 B_2 B_3 B_4 B_6 C_1

Common attributes of these three tools are: B_1, B_3, B_4, B_6 = What is acted upon by the tool
C_1 = Hand power required to control

Next Steps:

1. Expand each category with further examples.
2. Select tools from home and determine what is common about them.
3. Select tools from a particular kind of work and find common attributes
4. What are the special skills of the people who work with certain kinds of tools?

EXAMPLE 2. Begin with the three groups of common attributes and find as many tool examples for each as possible:

A. Action or purpose of the tool:
A_1 Tools - Aid the senses or capacities

Telescope	Microscope
Stethoscope	Lever
Magnifying glass	Pulley

A_5 Tools - Hold or bind material

Vise	Clamp
Tweezers	Clothespin
Pliers	Paper clip

B. What is acted upon by the tool:
B_1 Tools which act on paper:

Scissors	Folder
Knife	Sorter

B_{12} Tools which act on information:
Abacus
Calculator
Computer

C. Power required to control the tool:
C_1 Hand

Hoe	Hammer
Rake	Pliers
Pencil	Spatula
Ruler	Scraper

C_7 Electricity
Motor driven tools:

Mixer	Blender
Drill	Sander
Etcher	

Next Steps:

1. Expand each category. One tool may fit several categories. What is different about tools that fit several categories from tools that fit only one category?
2. What are examples of the work that is done with each category of tool? List examples of work by title or description.
3. Find community examples of different kinds of work.

3. Trace the development of tools.

   A. Trace a tool as far back as possible to see how it started.
   B. Compare materials used to make tools during different time periods.
   C. Find out how commercial tools are made.
   D. Where do ideas for new tools come from. How do these ideas get to be actual tools?

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CLASSROOM ORGANIZATION

Arrangement Ideas

Arranging a classroom is very demanding, and the initial input of energy and money will not be the final one. Additional materials will be required thoughout the year, and some kind of arrangement for continuous spending of small sums should be agreed upon between you and your administration. Continual spending of small sums does not necessarily mean that the overall spending will be greater. It is a matter of allocating the appropriated funds in a different way, since all the materials that will be needed during the year cannot be purchased in September.

You may consider classroom arrangements a few days before school opening. However, some teachers may like to wait until school opens and let the children share in the planning. It might help to make a tentative list of interest center activities in order to develop some idea of the kinds of spaces you want to provide initially.

* Take an inventory of your classroom.

  - The number of desks
  - Bookshelves
  - Other pieces of furniture
  - The electrical outlets
  - The amount of usable wall and floor space
  - The number of windows, doors, lights
  - Are there closets?
  - Storage space for supplies
  - Sink area
  - Usable projections (pipes, hooks, etc.)
  - Irregularities in the structure that may have some bearing on the use of the room
  - Alcove, adjoining small room

* List of activities may include:

  - Discussion area
  - General meeting
  - Reading
  - Writing
  - Mathematics
  - Science
  - Music
  - Art
  - Drama
  - Construction

Make a sketch or diagram of your classroom before you proceed to the actual job of rearranging. Decide which activities interest you the most. Focus your attention on one area, using all the furniture and resources you need in order to complete it. Arrange the area to your satisfaction. After the first area is completed, move on to the next most interesting one.

You may need more bookshelves, tables, dividers, etc. Look around the school, ask for donations from parents, build some furniture (Tri-wall is very useful.)

When two or three areas have been set up, possibilities for arranging the remaining classroom space may become clearer to you.

Remember, there will always be a gap between the ideal and the real, between your plans and the actual possibilities in the classroom, therefore, the classroom need not be in final shape. You and the children will be able to continue rearranging the classroom.

CLASSROOM ORGANIZATION

Arrangement Ideas

You may want to consider:

1. Are there areas which are unused?
   a. Unattractive: ugly, drafty, dark, cold, hot
   b. Too much traffic:
      . People walking through
      . Interruption of concentration
   c. Space too small for designated use:
      . Materials not conveniently on hand, shortage
      . Difficult to locate materials, replace materials
   d. More suggestions needed

2. Does arrangement cause dissension?
   a. Children do not have enough room to work
   b. Wobbly furniture, unstable tables
   c. Narrow passage ways
   d. Children not given enough interesting active alternatives

3. Some activities avoided.
   a. Too many written instructions
   b. More materials of an open-ended nature needed.
   c. Areas too public
   d. Space for small groups to work together too limiting
   e. Room too noisy
   f. Open space for movement not enough

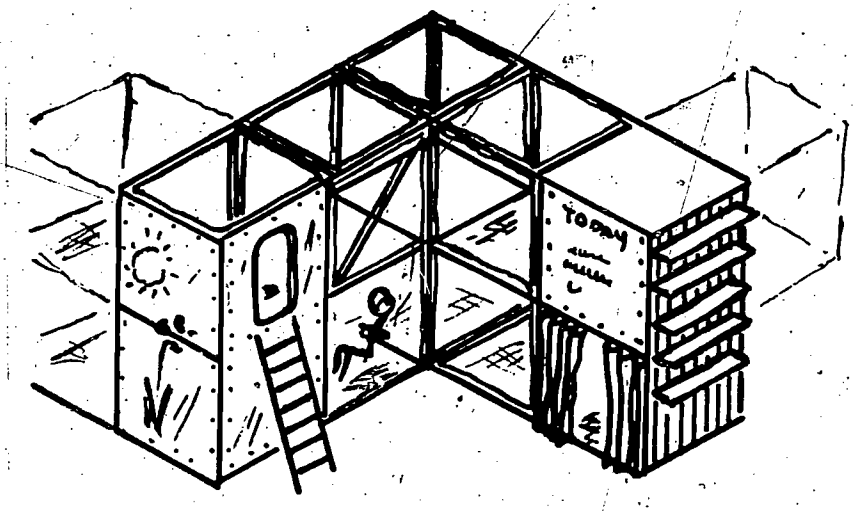
In addition you may want to rearrange the classroom in order to have space for an all-class project (publishing a newspaper, dramatic presentation) or other group activity.

Above all, you should include the children in your thinking and have some general discussions (green lighting) about how the room is being lived in and how it might be made better.

Remember classroom organization should, if at all possible, be flexible and open to adjustment in response to the character and interests of the occupants, not fixed according to some preset plan. No room has only one inevitable arrangement.

CLASSROOM ORGANIZATION

PHYSICAL ARRANGEMENTS



PLYWOOD MODULAR*

USE:

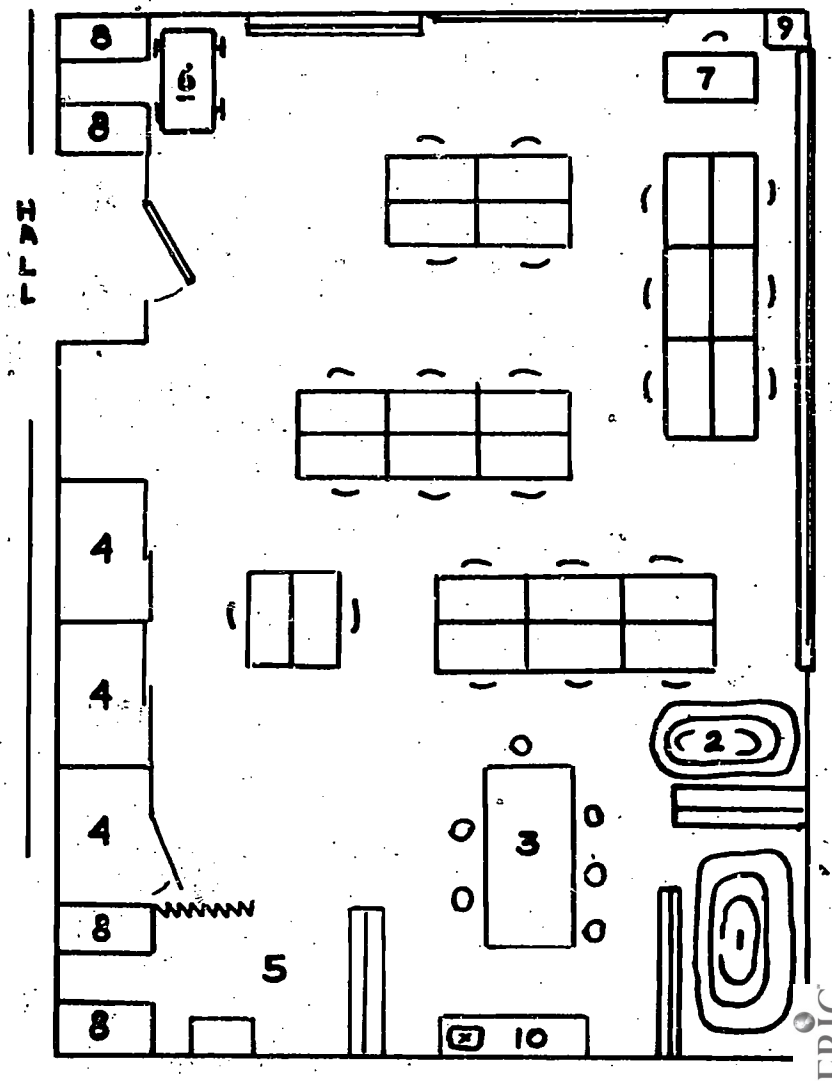
WALL PANELS	$\frac{1}{4}$"x4'x8'
FLOORS	$\frac{5}{8}$"x4'x8'
COLUMNS	$\frac{5}{8}$" PLYWOOD
BEAMS	$\frac{3}{4}$" PLYWOOD
BLOCKS	1½"x1½"x2¾" FIR

IDEA/PROBLEM

No classroom is ideal. When children learn by experiencing practical problems, they tend to work as individuals or in small groups. Ideally, they should have available a wide range of materials, plenty of flat surfaces on which to work, space to move freely, adequate sources of reference and ample display and storage space. Materials, equipment and books should be easily accessible so that children can find whatever they need when they need it. Be brave, Try an activity-centered-learning classroom.

* For details read:

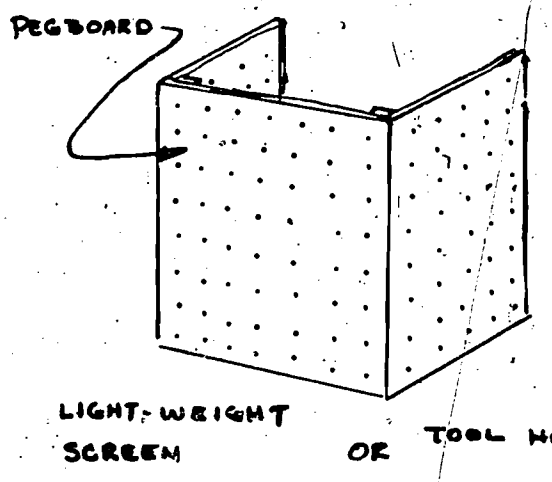
A Momento and Manual of Our Apprenticeship in Making Places and Changing Spaces in Schools, At Home and Other Places. Farallones Design, Point Reyes Station, California.

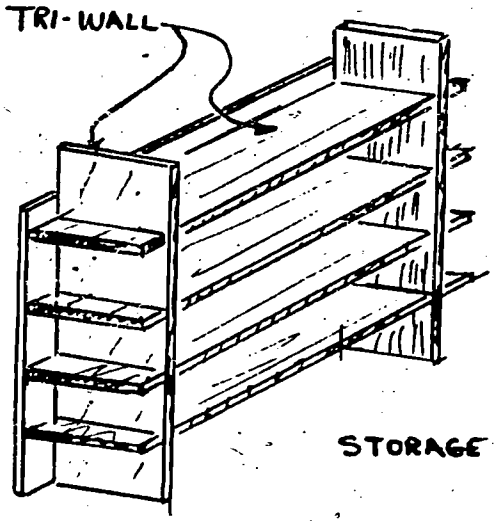


1. Reading: Small, private space for independent reading with a rug and soft furniture
2. Math: Shelves and rug under windows
3. Art: Near sink. Supply shelves, work tables
4. Drama: Box of dress-ups and closet storage space
5. Construction: Shelves for storage benches, tools, etc.
6. Cooking: Cart can be rolled over to sink area
7. Teacher's desk: May or may not be used
8. Coat closet: Mobile units possibly
9. File cabinet: For records, plans, etc.
0. Sink: With drinking fountain

CLASSROOM ORGANIZATION

PHYSICAL ARRANGEMENTS





COMMENTS:

* Various modes of learning can occur simultaneously.
* Provide periods when half the class can choose activities while the other half can continue to work at their desks with teacher guidance.
* Each interest area should have room for a limited number of children.
* More interest center activities can be introduced gradually as children learn how to handle the available choices.
* Some desks may serve as group work tables with plywood surfaces.
* Children can sit at their desks or on a carpet for group discussions.

Pupil Logs - Journals

As a teacher you naturally assume a positive attitude about the achievements of your children.

The introduction of Individual Pupil Logs or Journals will enable your children to become more responsible for their own learning. They will be able to keep records of their own progress, including plans for future study and investigations.

Logs or journals can be kept in two forms:

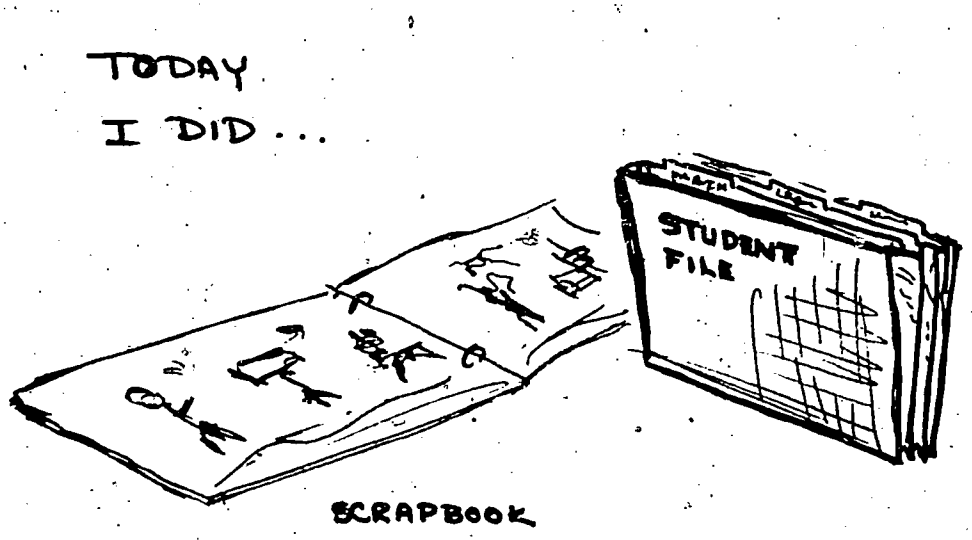
* Notebook or scrapbook with examples of students work in dated entries.

* Brief abstract or summary of day's work kept in a small notebook and dated.

Remember, effective feedback is best if the "Log" is used as a medium for communicating with the child as an individual. Be careful not to editorialize on grammar or penmanship too early or too often. Only inaccuracies in reporting should be corrected. Commendations of progress, suggestions and recommendations for future work can be made this way.

If the early primary grade child is not able to write, only the notebook or scrapbook may be used. However, older children can serve as their writers or stenographers to record the learner's dictation.

Individual Pupil Logs and Journals furnish some of the necessary information to show the directions and development of interests, attitudes, knowledge and skills in each child.



Any effective safety education program is a continous program which coincides with the aims of the school and is integrated with its total program.

In this section, remarks are restricted to those concerns which are most applicable to the elementary school. In no way should this be construed to imply a break or gap between the elementary and secondary program since the philosophy should flow and permeate the entire system.

A comprehensive safety program should provide for the following:

(a) Teacher Research
(b) College Course(s)
(c) Teacher and Student Guide Books

The most effective learning in the elementary school takes place when interest can be generated in the total school community. Effective habits and attitudes necessary for safe living will only surface when sincere concern in this phase of learning, supported by public commitment, permeates the school administration, instructional staff and children. The program should truly reflect cooperative thought and action. When such diverse interests and cooperative efforts exist, sound and gradual growth in safety habits and attitudes becomes a reality rather than spasmodic progress. In order to obtain unity of effort in the school program, agreements must be worked out among various departments of the system or among various reliable individuals as to definite areas of responsibility and action.

Adult interests must be utilized in order to secure the best possible results. It is essential that parents and the school representatives agree on the plan since behavioral patterns are formulated in early youth.

Fundamentals in Education for Safety

In developing a practical philosophy as the initial step in establishing a safety program in a school, the following ideas are offered for consideration:

(a) The protection of children should be a major educational objective. This objective cannot be effectively accomplished by haphazard, incidental instruction; it must be planned, organized and implemented. The school's responsibility is clearcut and far removed from the controversial category.
(b) Emphasis should be placed on constructive safety practices. It is unwise to stress the negative aspects of what results when individuals fail to act prudently. Safety education should, in effect, provide a spur to action, rather than acting as a brake.
(c) Participation is basic to success. The school program in safety must be implemented in such a manner as to involve every member of the school staff, as well as, every child.
(d) An accident-accounting system constitutes an integral part of safety planning. The seasonal approach to safety is effective in meeting changing needs during the year and in lending variety to the safety instructional program.
(e) Safety considerations are an important part of the planning of any school special event. Special activities, such as field trips, poster contests, athletic contests, school dramatics or festivals, provide opportunities for the cooperative formulation of safety standards and the development of acceptable safety practices.
(f) Safety weeks and similar occasions should also be an integral part of the safety plan.
(g) Proper planning should involve local and city-wide research in order to meet community needs and to eliminate safety hazards.

(h) The local school plan for safety must utilize the total safety resources of the community.
(i) Essentially, safety evolves from developing a total philosophy which results in proper attitudes. Attitudes favorable to safety should pervade the school's total program.
(j) Evaluation and the improvement of a program of this type can best be judged in terms of a lessening in the number and severity of accidents and near-accidents, in the development of improved safety practices and attitudes, in an increase in the amount and quality of participation in safety activities, and in the attainment of a constantly improving community attitude toward the school's safety program.

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New Jersey Department of Labor and Industry New Jersey "Safety Guides and Regulations," 1958.

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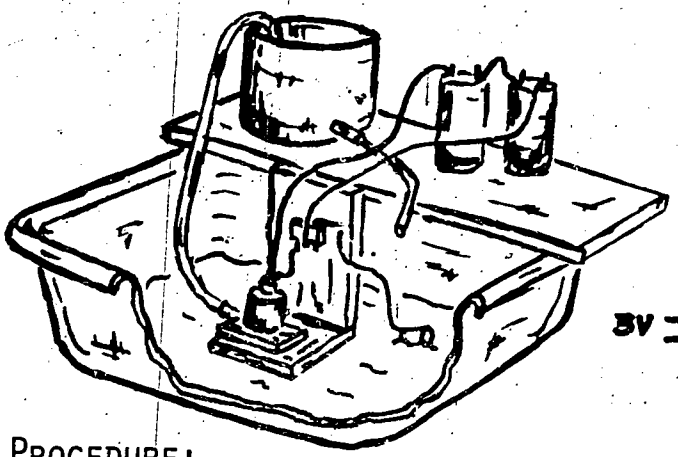
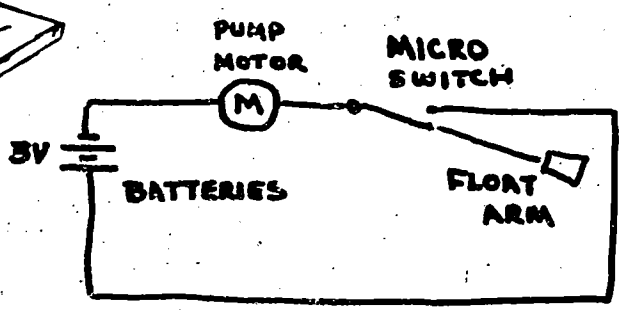
AN AUTOMATIC SYSTEM

IDEA/PROBLEM

Make a self-regulating or automatic system to perform a useful tasks. Compare and contrast it with other controlled devices and systems.





PROCEDURE:

1. Build platform support for pump and reservoir.
2. Insert plastic tube drain through punched hole at base of can.
3. Attach cork to length of aluminum wire. Attach wire to switch arm with tape or thread.
4. Mount switch. Bend cork arm to level of water. Cork movement will open or close switch.
5. Connect batteries to pump through switch. Manually operate switch to determine when pump turns on. Correct operation-switch arm is in up position. Add water.
6. Submerge lower portion of pump. Adjust cork float arm to turn pump on or off.

MATERIALS AND EQUIPMENT

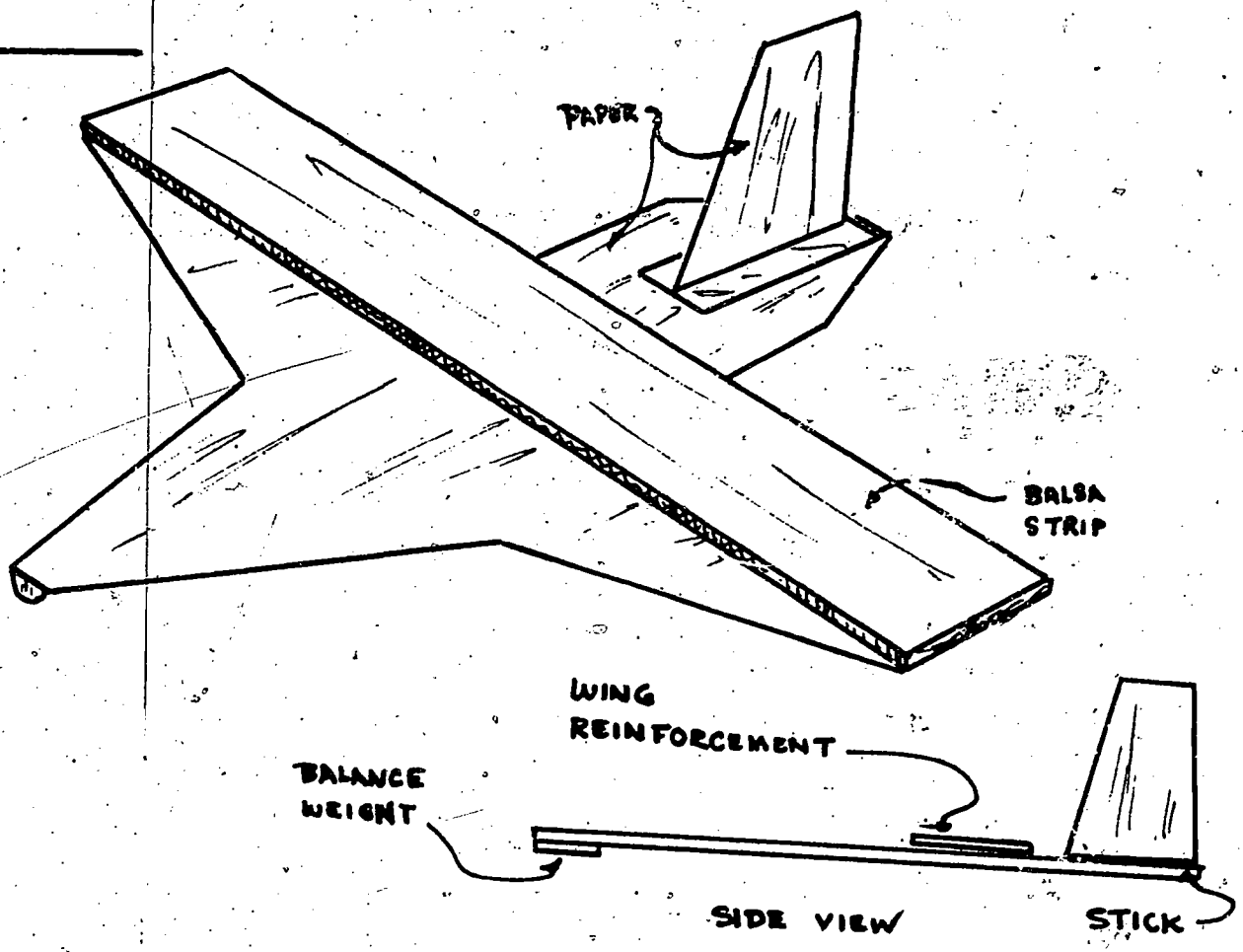
- 1 Micro switch such as Cutler Hammer JX40 @$.28 or similar switch
- 1 Miniature battery operated water pump such as Edmund Scientific type 50,345 @$2.25 or similar pump
- 1 Plastic dish pan
- 1 Large cork or piece of styrofoam
- 2 No. 6 - 1½ volt batteries
- Wood scraps for pump support
- Nails, screws, tape
- 1 Large tin can
- 1 piece plastic tubing ¼" inside diameter X 18" long
- 1 Claw hammer
- 1 Crosscut saw
- 1 piece 18 gauge aluminum wire X 12"

24

FOLLOW-UP:

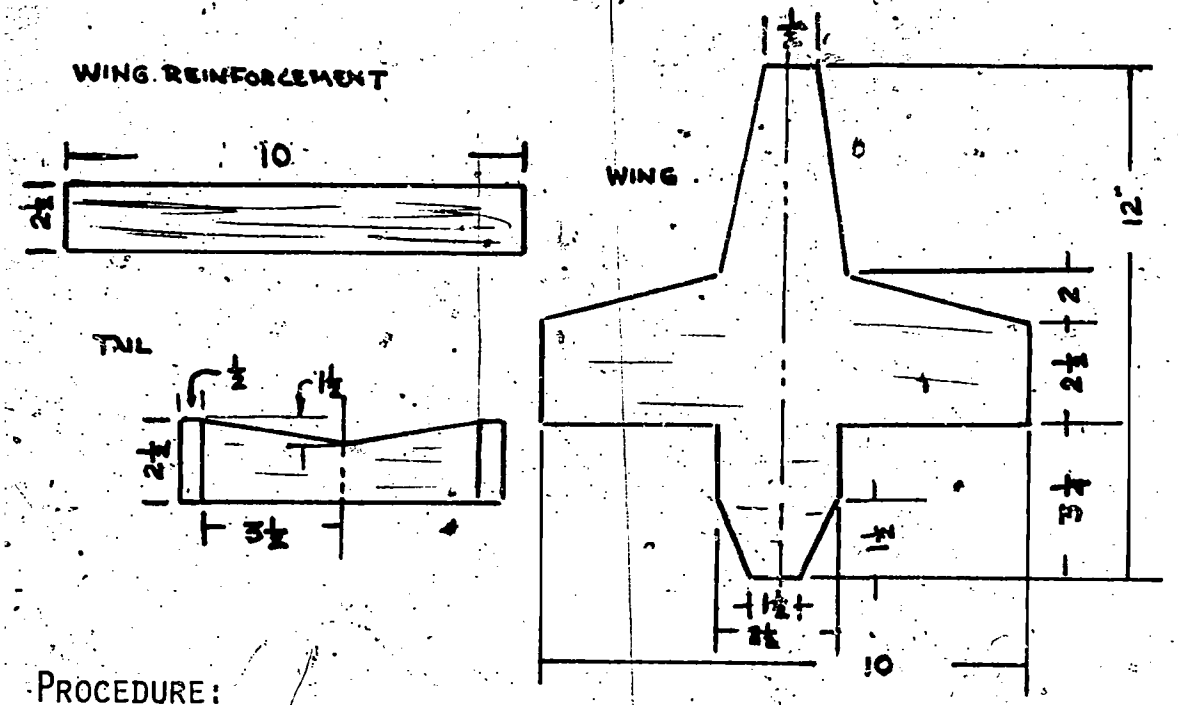
- What makes this water system automatic?
- What other automatic devices do you use? How do they operate? Find out.

AIRCRAFT



IDEA/PROBLEM

Because every thrown object flies, it is useful to establish criteria to determine the success or failure of the flight. These criteria must exhibit aerodynamic characteristics that will cause it to fly. In addition, the object must be under control to fly a predetermined course in a somewhat stable manner. Making a paper airplane can be challenging and exciting. Visual observation will be helpful in determining what type of adjustments you can make with your airplane



PROCEDURE:

1. Draw details on construction paper.
2. Cut out details
3. Bend up the flanges of the tail 90 degrees.
4. Fold the tail along the symmetrical center line to form a "T" with flanges.
5. Cement the two large panels of the tail together.
6. Cement the wing to the stick.
7. Cement wing reinforcement to the wing.
8. Cement tail to the aft position of wing.
9. Test launch airplane.
10. Balance the airplane (lightly at first increasing weight.) Gently launch airplane and fly.

MATERIALS AND EQUIPMENT

- Balsa sticks
  1/8" X 1/4" X 12" inches
- Paper - 70 lb. construction
- Cement - Rubber cement
- Balance weights - paper clips, clay, etc.
- Tape - masking or adhesive

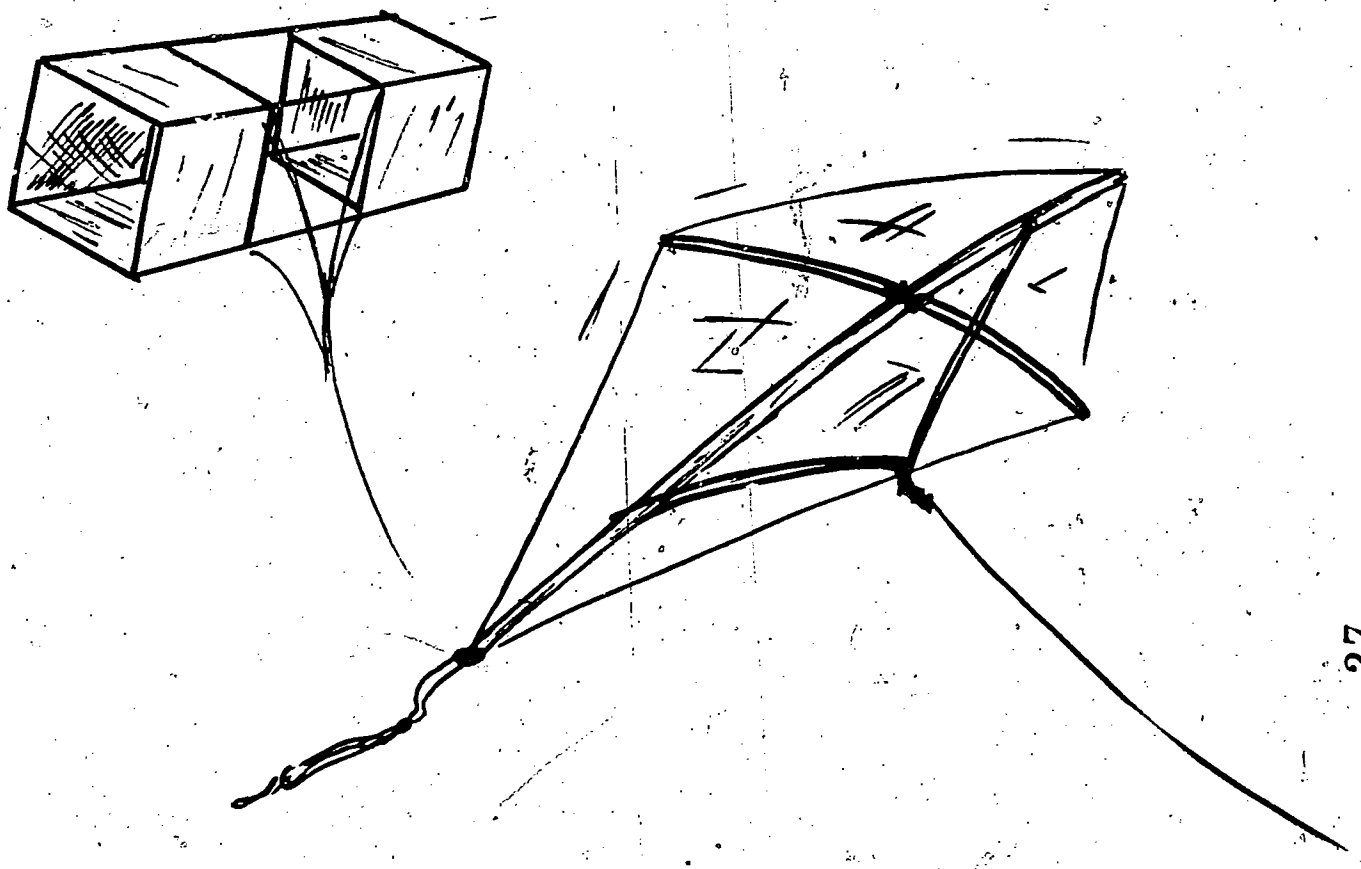
- Scissors
- Ruler
- Pencil

FOLLOW-UP:

- Encourage dimensional changes.
- Have students develop flight measurement instruments.
- Study the careers available within the aviation industry.

AVIATION - AEROSPACE

FLYING KITES



27

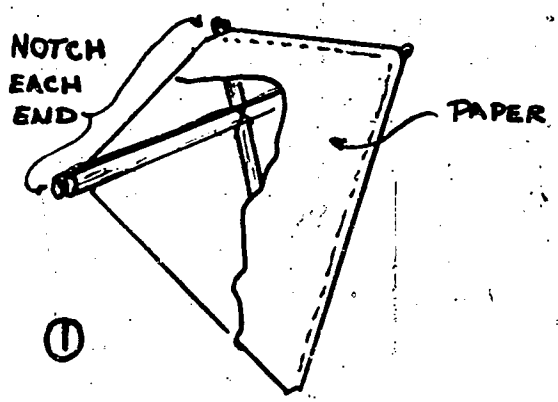
IDEA/PROBLEM

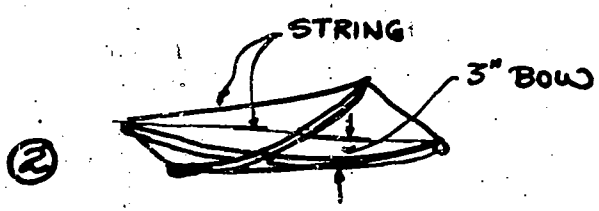
Any object that moves independently through the air and is not falling directly to the ground is flying. The ability of an object to remain aloft is determined by its weight, its shape and force driving it. Tissue paper in the wind can remain aloft for some time but is not manageable; therefore, in addition to the ability to fly, the object must be under control. The kite helps us experiment with concepts of flight.

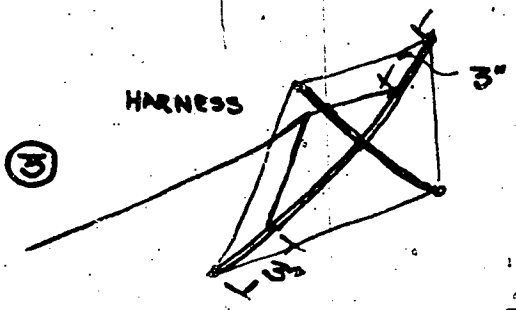
FLYING KITES

MATERIALS AND EQUIPMENT

Dowel ¼" diameter X 22"	frame
Dowel ¼" diameter X 30"	frame
Tissue paper 24" X 30"	cover
String - 10 ft. roll	harness
Tape	
Glue	
String - 250 ft.	
Hand saw	
Scissors	
Ruler	







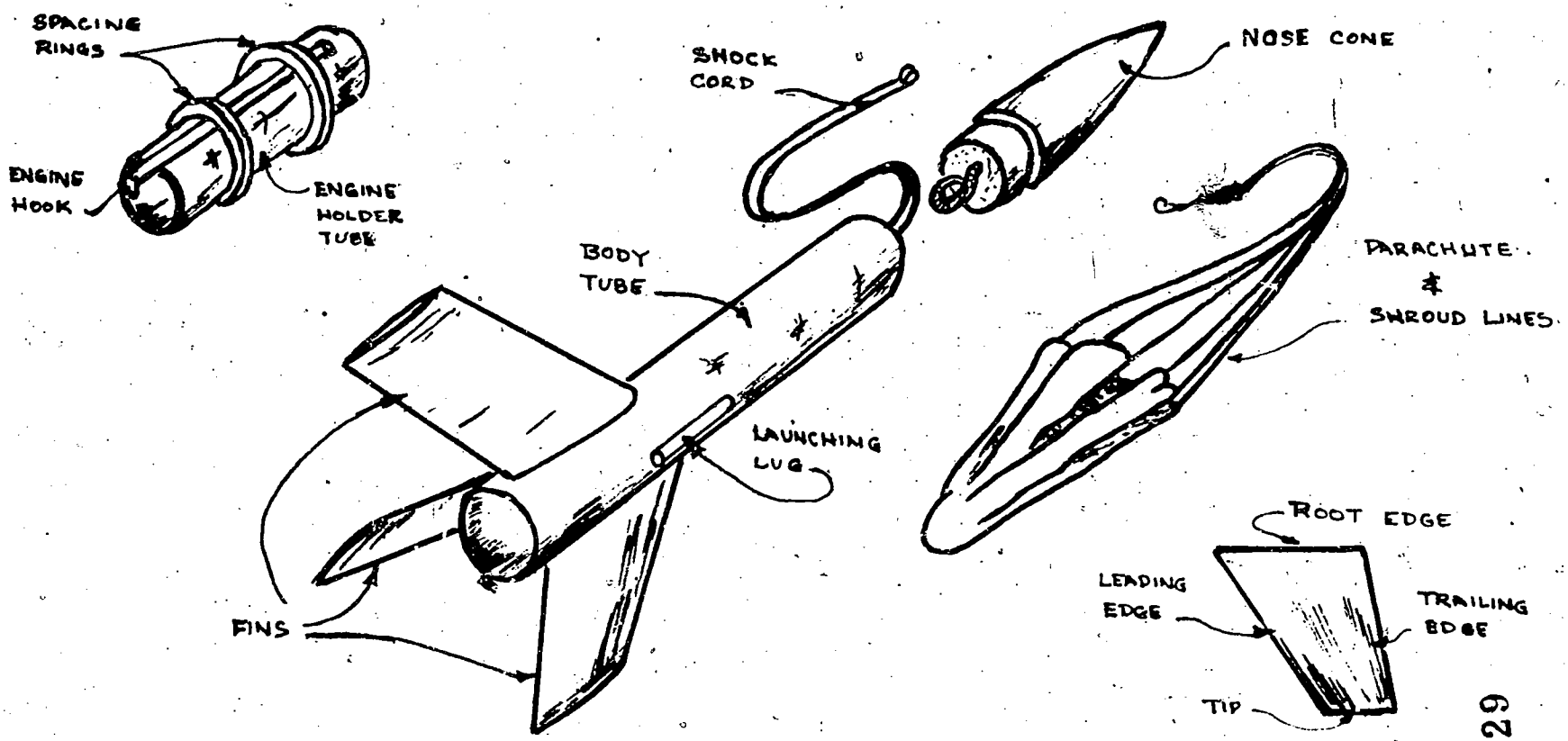
PROCEDURE:

1. Cut dowels to size and notch each end.
2. Tie dowels together to form frame and string frame.
3. Cover string frame with paper, overlap "string frame" by ½ inch and glue over.
4. Tie horizontal dowel to make a 3 inch deep bow, after covering frame with paper.
5. Attach harness.

FOLLOW-UP:

- Try other design systems.
- How has the concept kite helped mankind?
- Development of lighter-than-air crafts.

ROCKETRY



29

IDEA/PROBLEM

Everyone on earth is influenced by man's remarkable achievements in the air and in space. Meaningful learning experiences in which students actually build, launch and safely recover their rockets provides a realistic opportunity for students to apply theoretical learnings.

MATERIALS AND EQUIPMENT

Basic Model Rocket Kit
Modeling knife
Metal-edged ruler
Sand Paper - fine or extra fine
Scissors
Glue (Model)
Pencil
Cardboard
Sanding sealer
Paint brush
Paint (Dope)
Paint thinner

For every action there is an opposite and equal reaction.

Isaac Newton 1687

PROCEDURE:

1. Gather and read basic information relating to model rocketry. Two sources are:
   Saltrick, Daniel F. and A. Kubota. Aerospace Education and Model Rocketry - An Educator's Guide for Grades Four through Ten. Penrose, Colorado: Estes Industries, Inc., 1970.

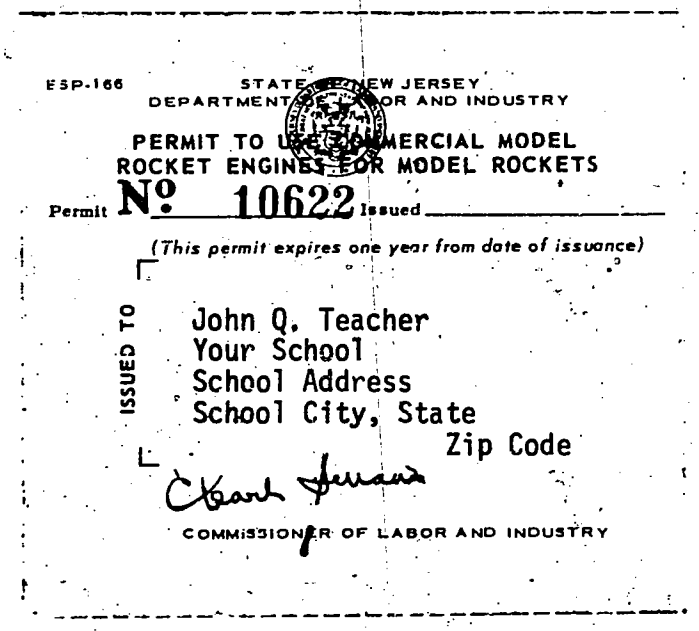
   Estes Industries Inc., Why Model Rocketry? Penrose, Colorado, 1969 rev.
2. Learn basic rocket nomenclature as you read and build.
3. Obtain a model rocket kit (single-stage).
4. Read instructions through carefully before starting.
5. Examine parts packed in kit.
6. Construct and finish your model rocket.
7. Learn the model rocket safety code. Note: You must obtain a permit to use model rocket engines in New Jersey.
8. Compare the performance of different model rocket engines in the same rocket.
9. Build an electrical ignition system for launching.
10. Carefully prepare a model rocket for launching and "Blast-off."

FOLLOW-UP:

- Use the basic data from launches to construct graphs which illustrate altitude reached.
- Construct more refined instruments for determining the altitudes reached by rockets.
- Improve standard designs for models (reduce drag, etc.)
- Design more refined launch systems
- Study career opportunities within the aerospace industry.
- List new vocabulary.

AVIATION - AEROSPACE

Model Rocket Engine Permit



ESP-166 STATE OF NEW JERSEY
DEPARTMENT OF LABOR AND INDUSTRY

PERMIT TO USE COMMERCIAL MODEL ROCKET ENGINES FOR MODEL ROCKETS

Permit No. 10622 Issued _____

(This permit expires one year from date of issuance)

ISSUED TO
John Q. Teacher
Your School
School Address
School City, State
Zip Code

Edward Jerman

COMMISSIONER OF LABOR AND INDUSTRY

Idea/Problem

Model Rockets using solid fuel electrically ignited engines may be built from kits by anyone. However, you must be 21 years old and hold a permit to handle the solid fuel rocket engines in New Jersey. A permit issued by the state is necessary.

Procedure:

A New Jersey teacher may obtain a permit by sending an application request on school stationery and indicating you are a teacher to:

State of New Jersey
Department of Labor and Industry
Bureau of Engineering and Safety
1100 Raymond Boulevard
Room 419
Newark, New Jersey 07102

You will receive an "Initial Application for Permit to Use Model Rocket Engines" and safety regulation No. 24, governing rocket experimentation by amateurs.

Proceed with application instructions which you will receive.

ROCKETRY SAFETY CODE*

1. Construction - My model rockets will be made of lightweight materials such as paper, wood, plastic and rubber, without any metal as structural parts.

2. Engines - I will use only pre-loaded factory made model rocket engines in the manner recommended by the manufacturer, I will not change in any way nor attempt to reload these engines.

3. Recovery - I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.

4. Weight Limits - My model rocket will weigh no more than 453 grams (16 ozs.) at liftoff, and the engines will contain no more than 113 grams (4 ozs.) of propellant.

5. Stability - I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.

6. Launching System - The system I use to launch my model rockety must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.

7. Launch Safety - I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.

8. Flying conditions - I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft, or under any conditions which might be dangerous to people or property.

9. Launch Area - My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.

10. Jet Deflector - My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.

11. Launch Rod - To prevent accidental eye injury I will always place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is not in an upright position.

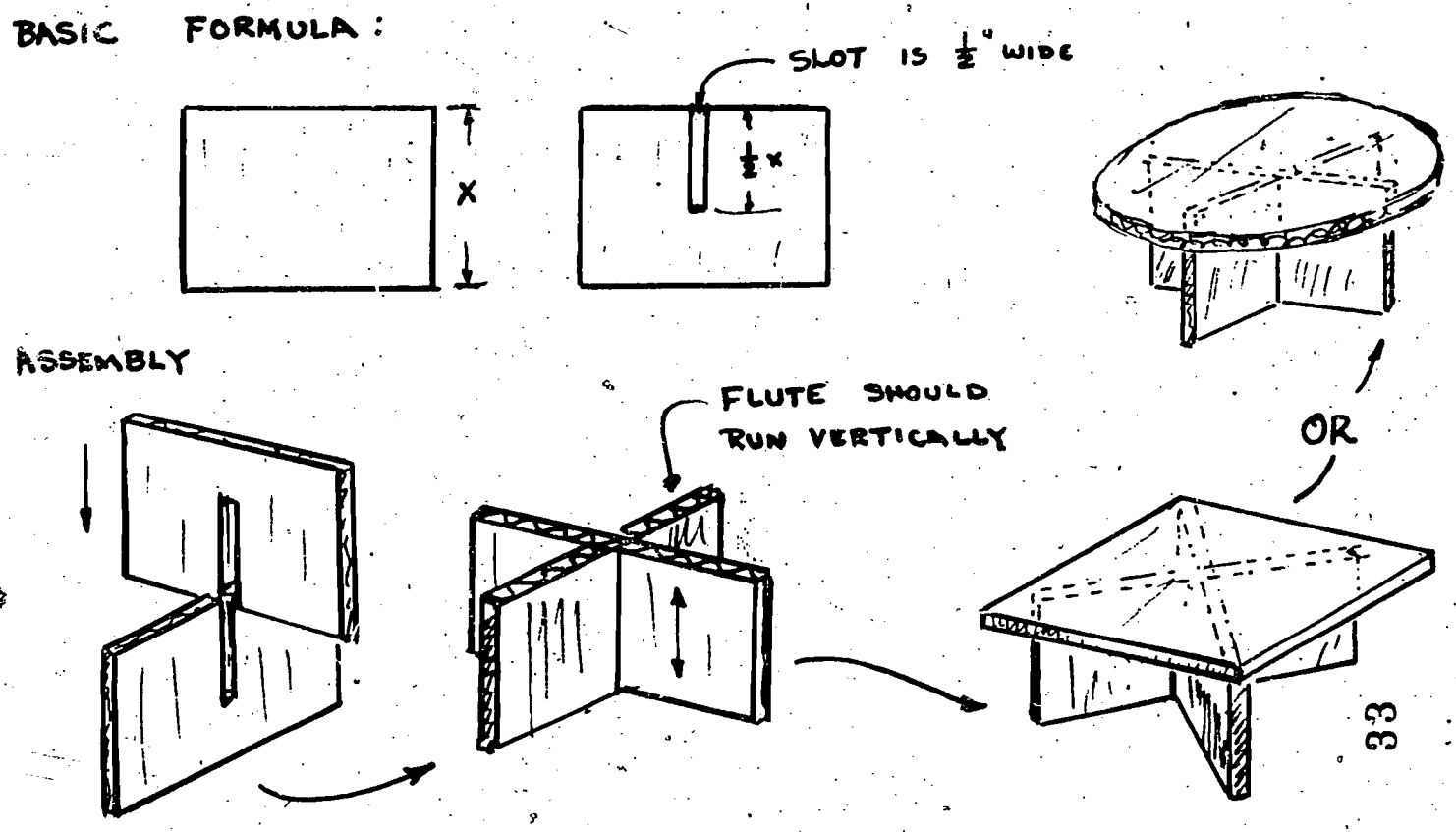
12. Power Lines - I will never attempt to recover my rocket from a power line or other dangerous places.

13. Launch Targets and Angle - I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.

14. Pre-Launch Test - When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

* Saltrick, Daniel F. and A. Kubota. Aerospace Education and Model Rocketry - An Educator's Guide for Grades Four Through Ten. Penrose, Colorado: Estes Industries, 1970.

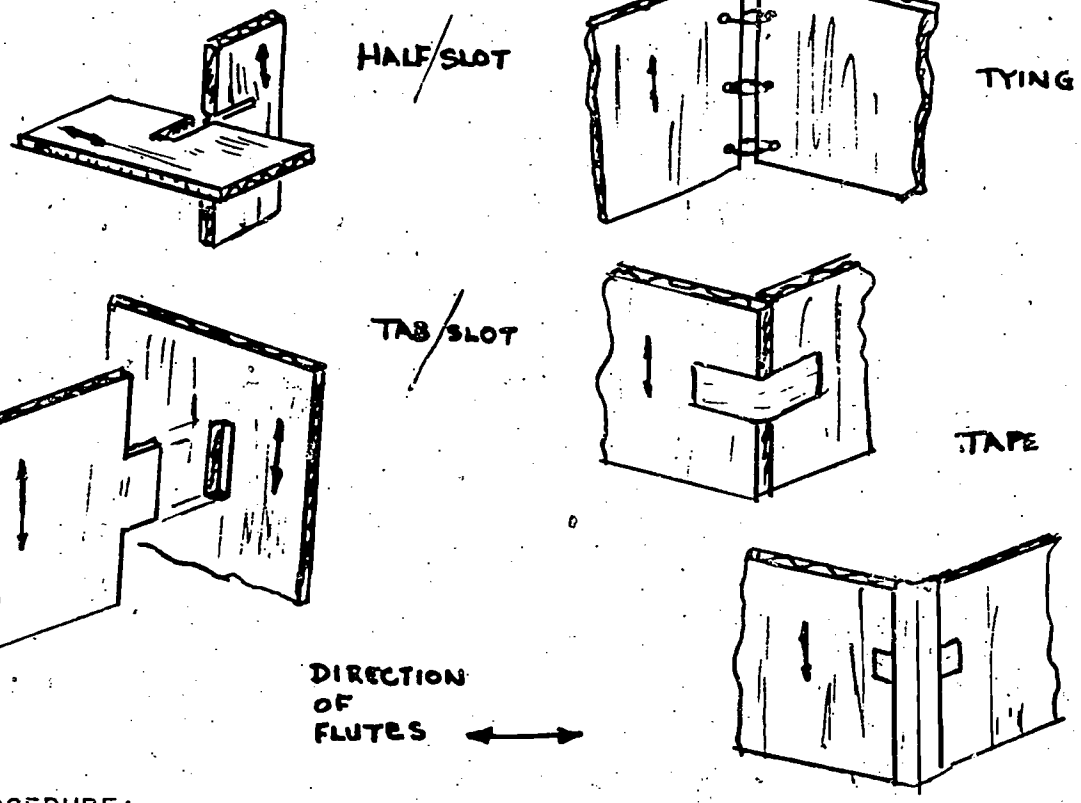
BUILDING WITH CARDBOARD



IDEA/PROBLEM

Classrooms with access to cardboard and tools give children an involvement with the notion that they can shape things to suit their ideas. The characteristics of cardboard will lend its use to the design and the development of genuinely useful "learning things."

JOINTS:



PROCEDURE:

1. Sketch-out various ideas you may want to construct.
2. Examine tri-wall material to determine your construction technique.
3. Note greatest strength in direction in which flutes run.
4. Layout and measure material to determine dimensions.
5. Check over and cut out.
6. Assemble materials.

MATERIALS AND EQUIPMENT

Tri-wall
Tape, 2" wide, paper or cloth
White glue
Paint: Use latex on both sides of any surface
Dowel 3.4", 1/4"

Circle cutters
Hole cutters 1/2", 3/4", 2 1/16"
Slot cutters
Strip cutters

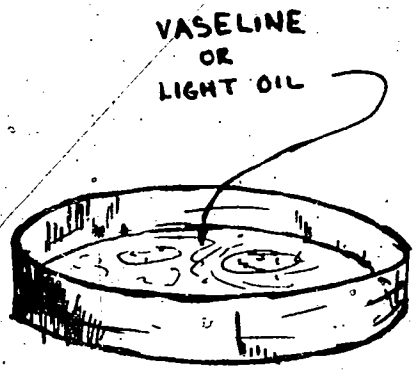
Available in kits from WOR & TRE

Spring clamps
Matte knife
Tape measure
Sabre Saw
Hand Saw
Mallet

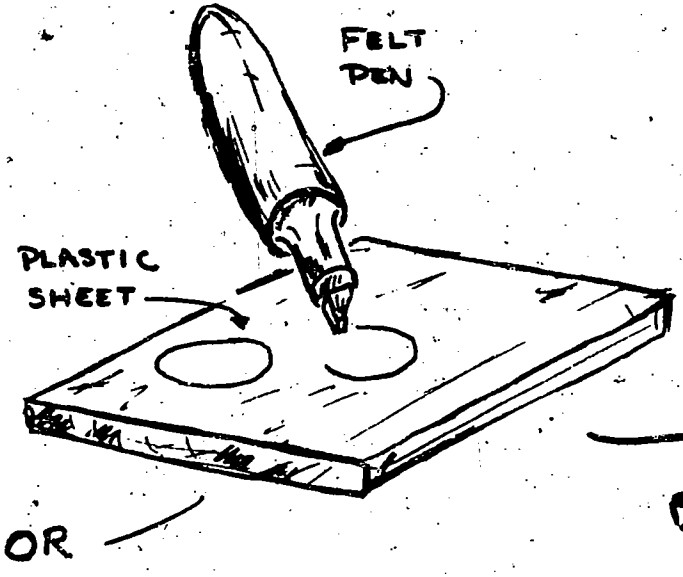
FOLLOW-UP:

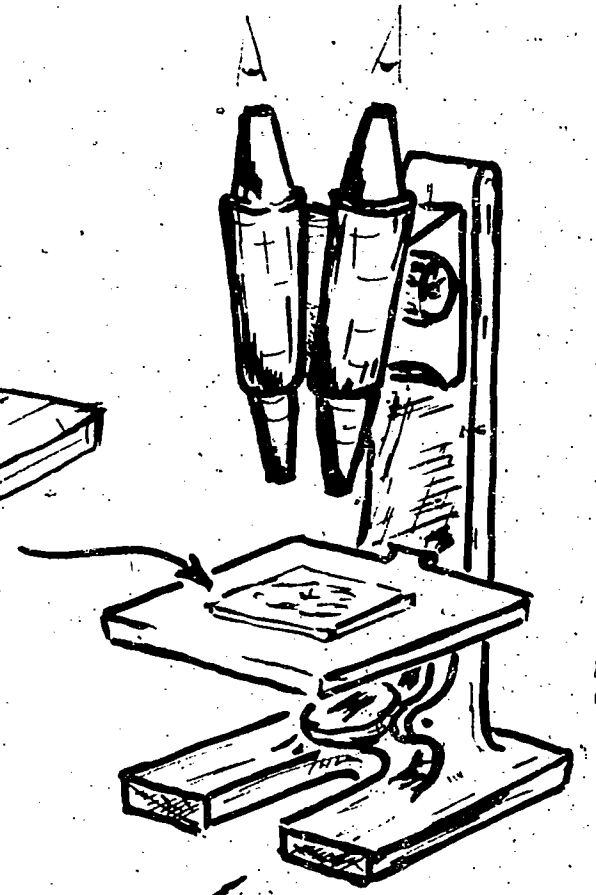
Read - The Further Adventures of Cardboard Carpentry - Son of Cardboard Carpentry. Watertown, Mass. Workshop for Learning Things, Inc., 1972

AIR QUALITY SAMPLING



PETRI DISH

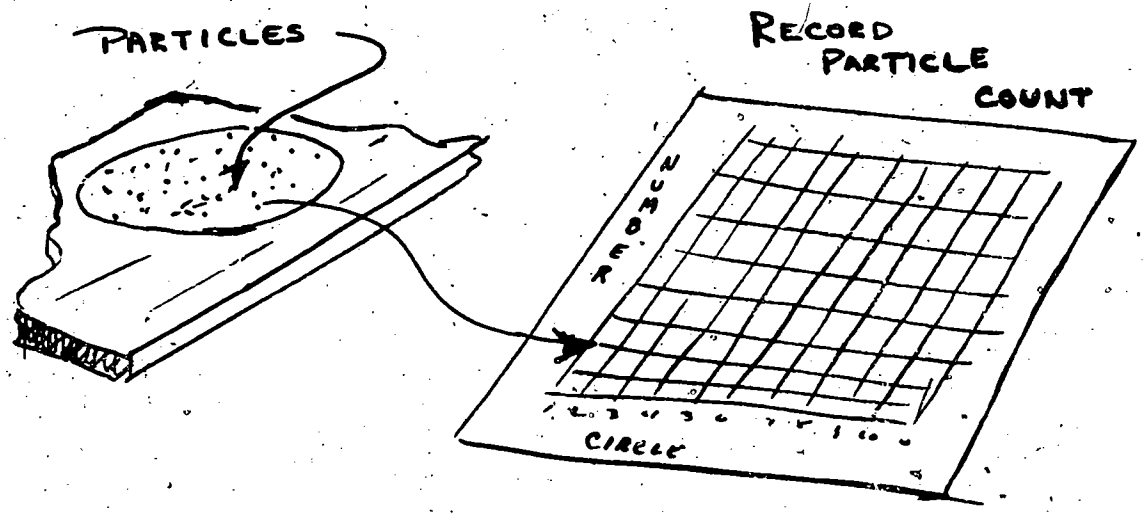




IDEA/PROBLEM

Periodically sample the air inside and outside a building you are often in. What can you say about the air you breathe?

AIR QUALITY SAMPLING



MATERIALS AND EQUIPMENT

1 B & L Stereo Microscope
2 disposable petri dishes
1 tube vaseline
OR
1-can light oil
Graph paper
Felt tip pen

PROCEDURE:

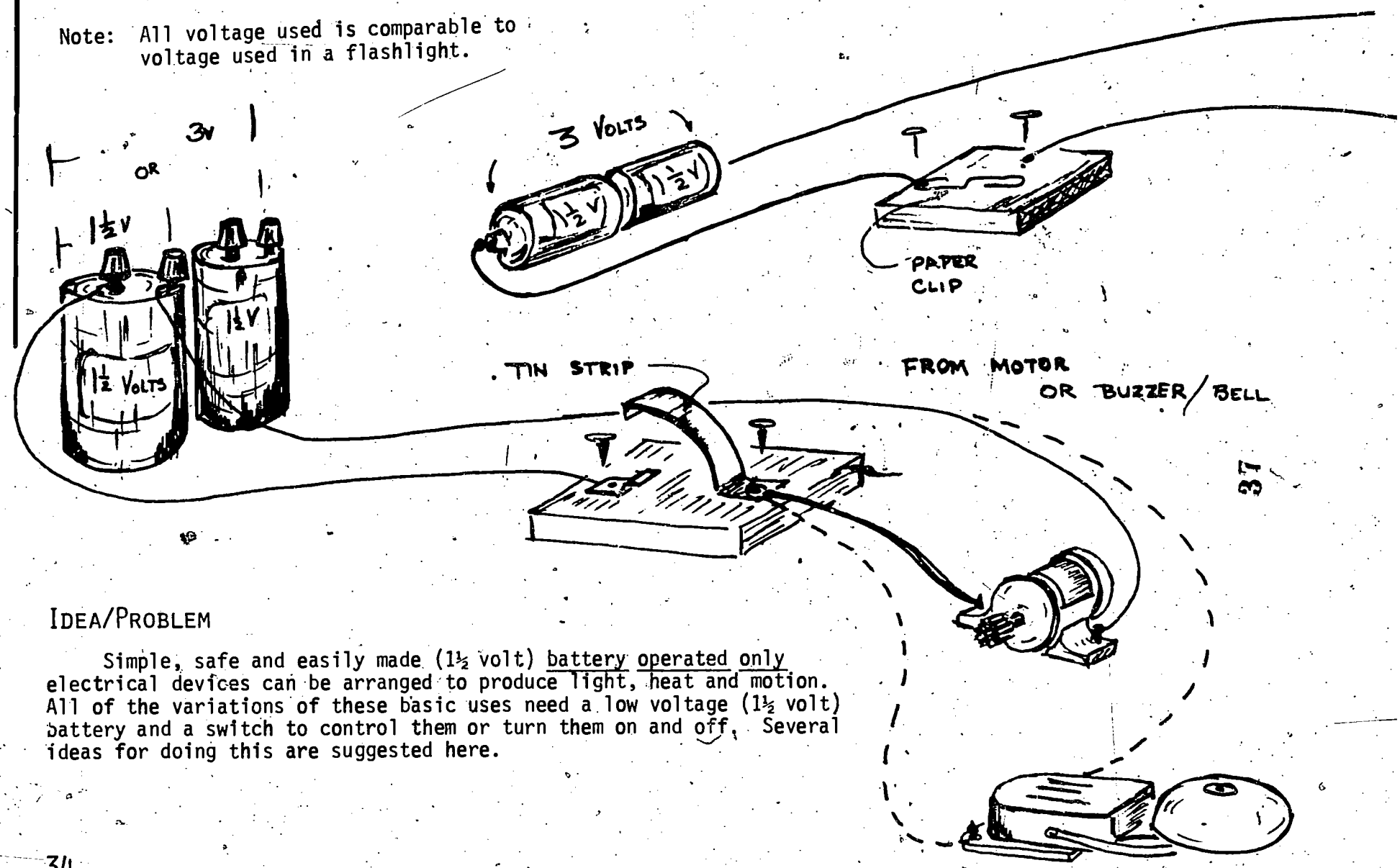
1. Select a clear plastic sheet about 3" X 3" or use a disposable petri dish. Smear a thin coat of vaseline or light lubricating oil over the inside surface of each half of the petri dish.
2. Carefully mark 2 or 3 circles about penny size on the outside of each dish with a felt tip pen. Number them 1-2-3.
3. Now, examine each circle area under a microscope and count the number of particles you observe. Record this number for each circle.
4. Next, place each dish at a location at which you wish to sample the air - inside and outside.
5. Collect the dishes at hour or day intervals and again count the particles in each circle. Record this number for each circle.
6. Make a graph of your results and share them with others.

FOLLOW-UP:

- When is the air polluted?
- Find the pollution index in a local paper. Keep a record of this index over a period of time. Compare this index with your own samples.
- Who are the people in your community who work on problems like this? Would you like this kind of work?

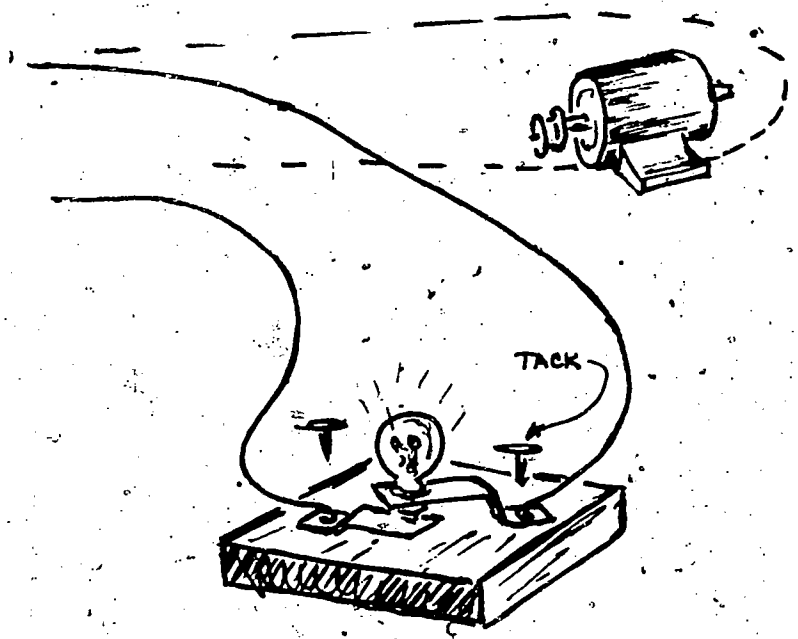
BATTERIES AND SWITCH IDEAS

Note: All voltage used is comparable to voltage used in a flashlight.



IDEA/PROBLEM

Simple, safe and easily made (1½ volt) battery operated only electrical devices can be arranged to produce light, heat and motion. All of the variations of these basic uses need a low voltage (1½ volt) battery and a switch to control them or turn them on and off. Several ideas for doing this are suggested here.



PROCEDURE:

1. Look at the diagrams to get an idea for connecting and arranging batteries and switches to any low voltage (1½ - 6 volt) device you make.*

2. Prepare one battery-switch idea, then go on to use it to power and control the electrical devices you make.

* Three sources for some first experiences with electricity:

Elementary Science Study, Batteries And Bulbs II, Newton, Massachusetts, E.S.S., Education Development Center, Inc., 1969.

Newing, F.E. and R. Barwood, Magnets, Bulbs and Batteries. A Lady Bird Junior Science Book, Loughborough, England, Wills and Hepworth Ltd., 1962.

UNESCO, Source Book for Science Teaching. New York: United Nations, 1962 Revised ed.

ELECTRICITY

BATTERIES AND SWITCH IDEAS

MATERIALS AND EQUIPMENT

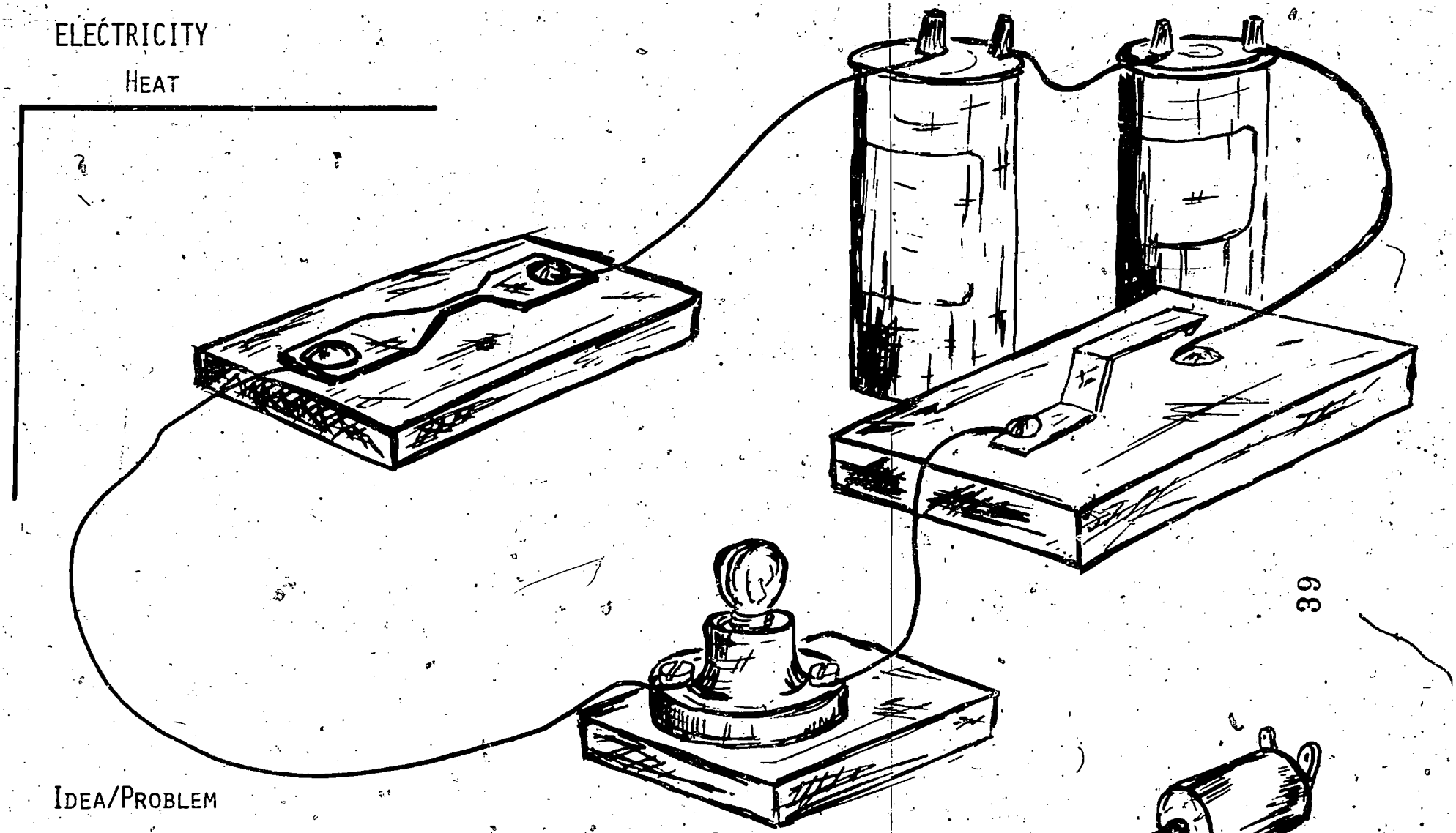
- 4 1½ volt battery-'D' cells
- 2 No. 6, 1½ volt battery
- 1 Box Paper clips
- 1 ¼ lb. spool, No. 20 or No. 22 insulated solid copper hookup wire
- 1 Box Thumb tacks
- Scrap wood
- No. 82 rubber bands 2½" long X ½" wide
- 1 No. 100 Miller wire stripper-cutter
- 1 Pair Tin snips
- 1 Tin can

FOLLOW-UP:

- Use a battery and switch to control a distant lamp.

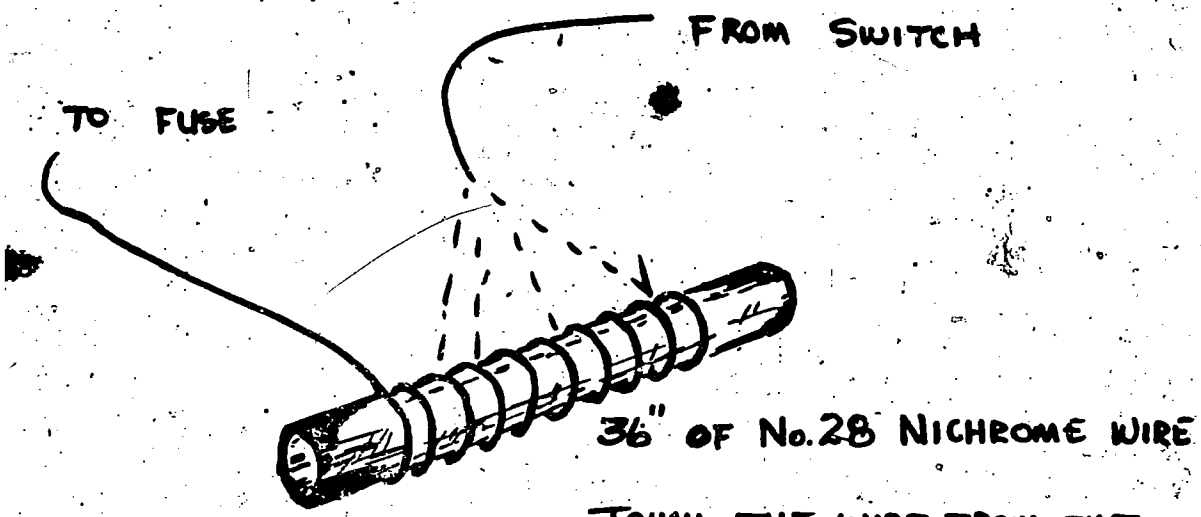
- Arrange batteries and switches to light a lamp whenever anyone comes in a door.

- Use your battery and switch arrangement to test miniature lamps, motors, bells and buzzers.



IDEA/PROBLEM

Make a fuse then test it in a circuit with a motor, lamp and resistance (nichrome) wire to see what a fuse does.



TOUCH THE WIRE FROM THE SWITCH AT DIFFERENT POINTS ON THE NICHROME WIRE. OBSERVE THE FUSE AS YOU DO THIS.

PROCEDURE:

1. Arrange materials to make a circuit as shown in the diagram with the lamp.
2. Close the switch to light the lamp. Then, place a wire (short circuit) across the lamp socket terminals. Does the fuse open or move? Cut the fuse as thin as possible in the center until it opens when you place the wire across the lamp terminals.
3. Substitute first the toy motor, then the piece of nichrome wire in place of the lamp. Place a new aluminum foil fuse in the circuit. Again short out the motor and nichrome wire.
4. What do you observe from the above experiment?

MATERIALS AND EQUIPMENT

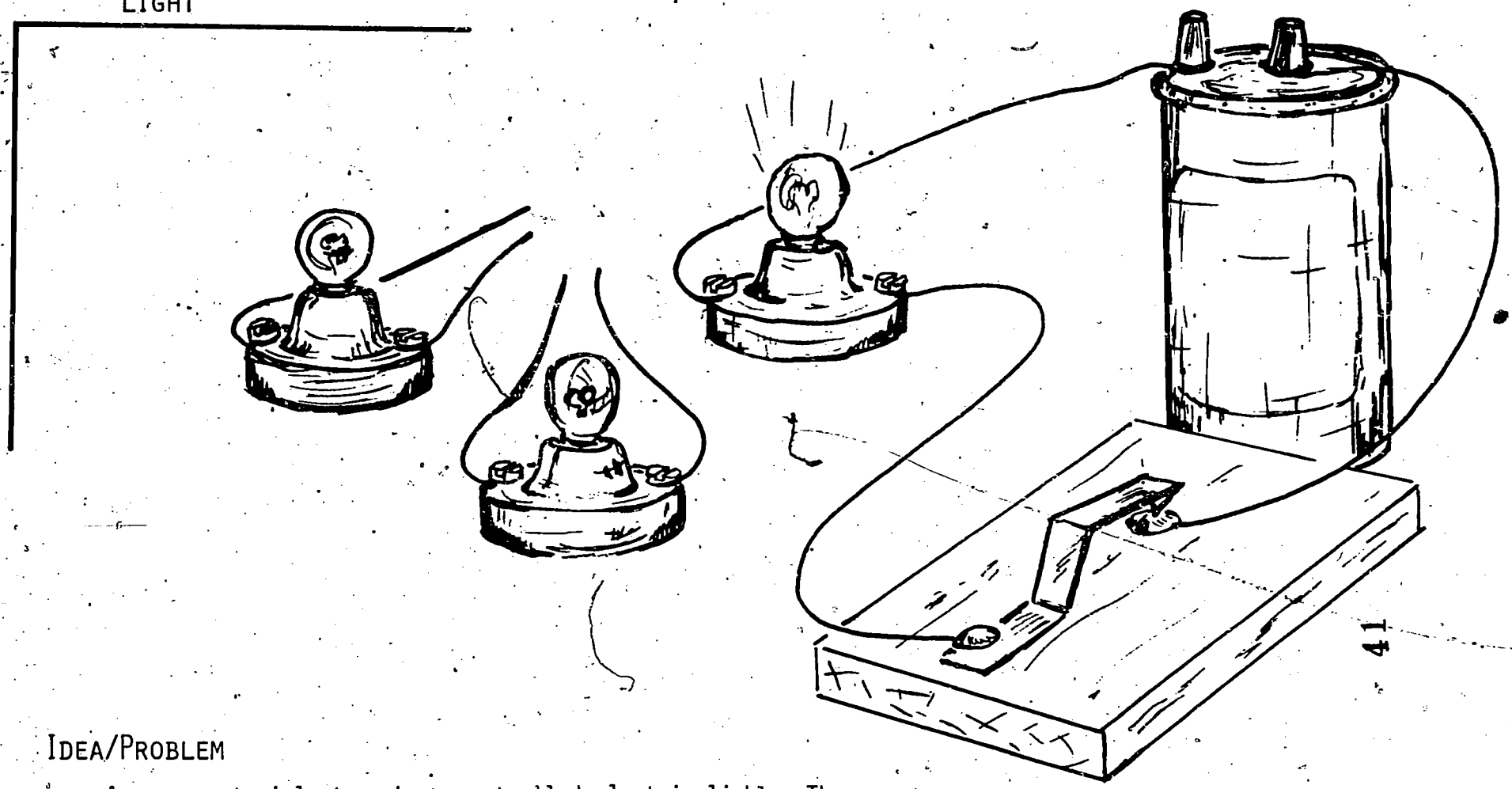
- 1 Battery-switch combination but with two No. 6 Dry Cells
- 2 No. 222 Miniature lamps
- 6 pcs. Aluminum foil ½" X 3"
- 4 Thumb tacks
- 2 Miniature lamp holders
- 1 3/4" X 3" X 4" Wood base
- 1 pc. No. 28 Nichrome wire about 24" long
- 1 1½-3 Volt toy motor
- 1 ½" X 12" dowel rod

FOLLOW-UP:

- Find out more about the heating effect of electricity.
- How does a thermostat work? Find out, then try to make one.

ELECTRICITY

LIGHT



IDEA/PROBLEM

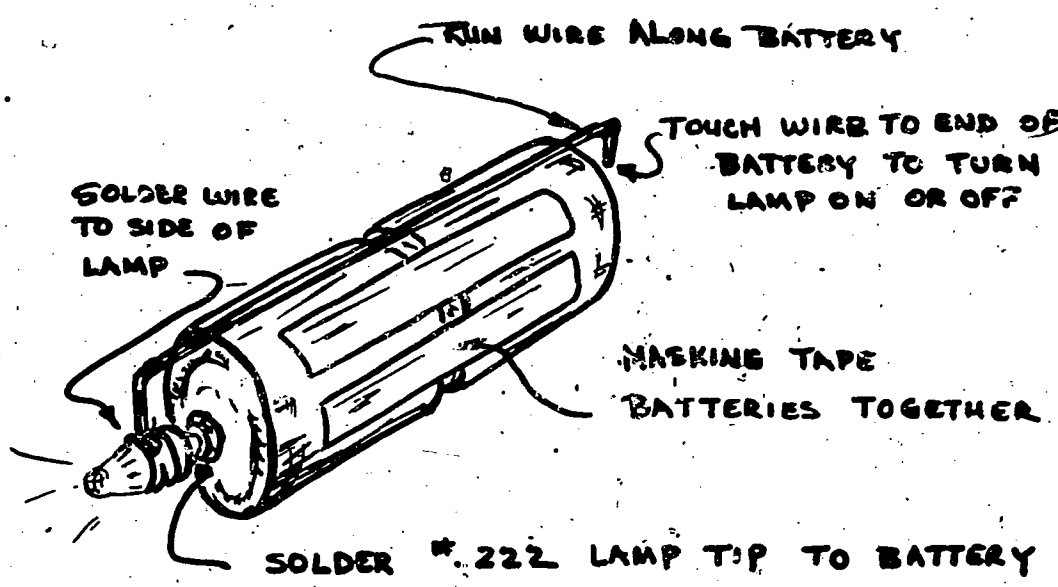
Arrange materials to make a controlled electric light. Then use it as a room light, flashlight, model light or as a light with which to send code.

ELECTRICITY

LIGHT

MATERIALS AND EQUIPMENT

- 1 battery-switch combination
- 1 each miniature lamps: No. 48, No. 222, No. 112*
- ¼ lb. spool, No. 20 insulated copper wire
- 1 Paper clip
- Roll masking tape
- 1 Soldering gun and solder
- 1 Wire cutter-stripper
- 3 Miniature screw base lamp sockets



PROCEDURE:

1. Arrange battery-bulb in a way that allows you to control the light.
2. Look at the sketches to get an idea of how the parts will fit together.
3. Make your own flashlight.

* Miniature lamp information:

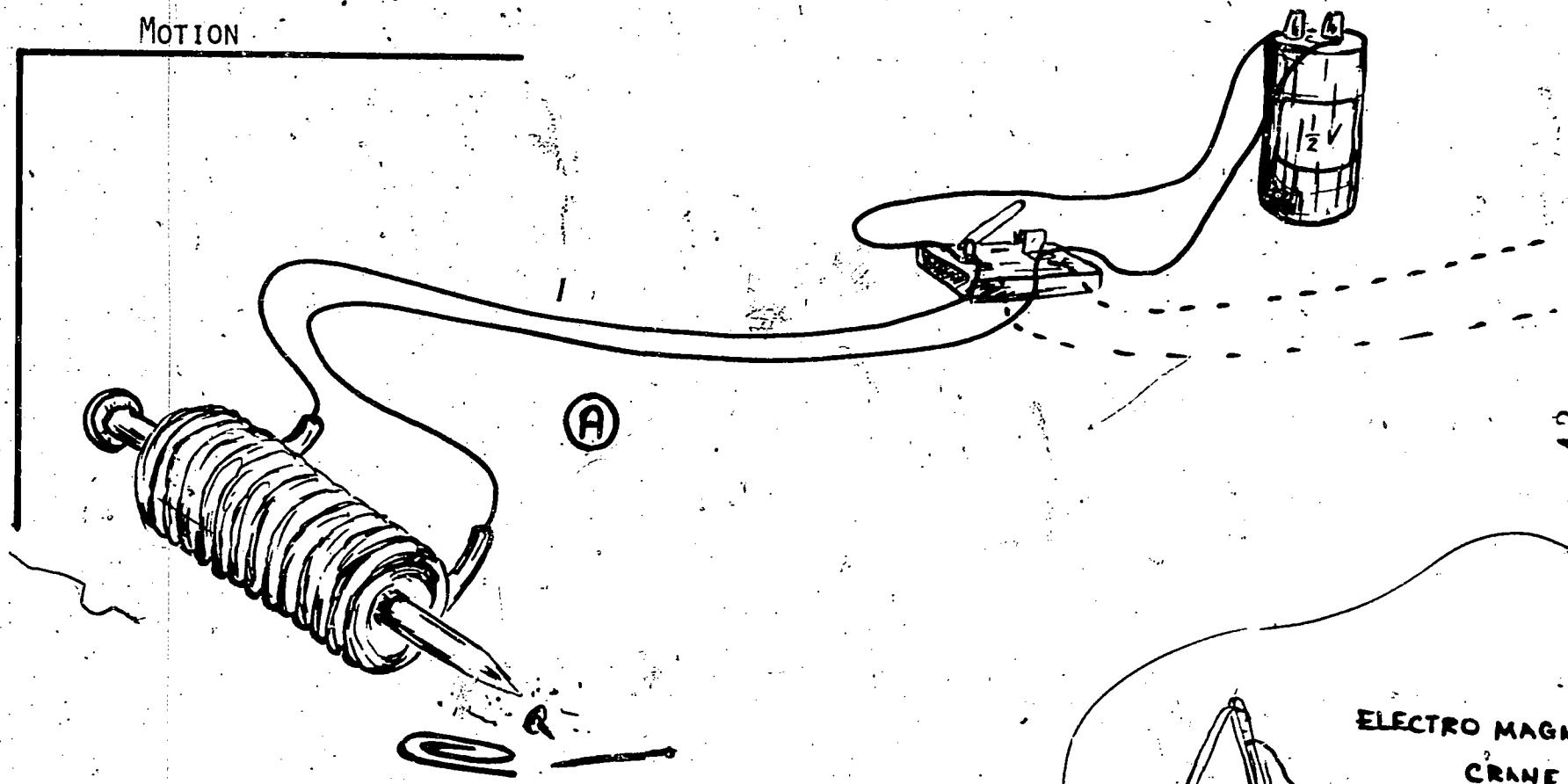
No. 112 lamp operates on approximately 1.2 Volts
No. 48 lamp operates on approximately 2.0 Volts
No. 222 lamp operates on approximately 2.2 Volts

FOLLOW-UP:

- What is the effect on the lamp when batteries are connected negative (-) to positive (+) and negative (-) to negative (-) and positive (+) to positive (+)?
- Compare your arrangement with a commercial flashlight. How are they alike or different?

ELECTRICITY

MOTION



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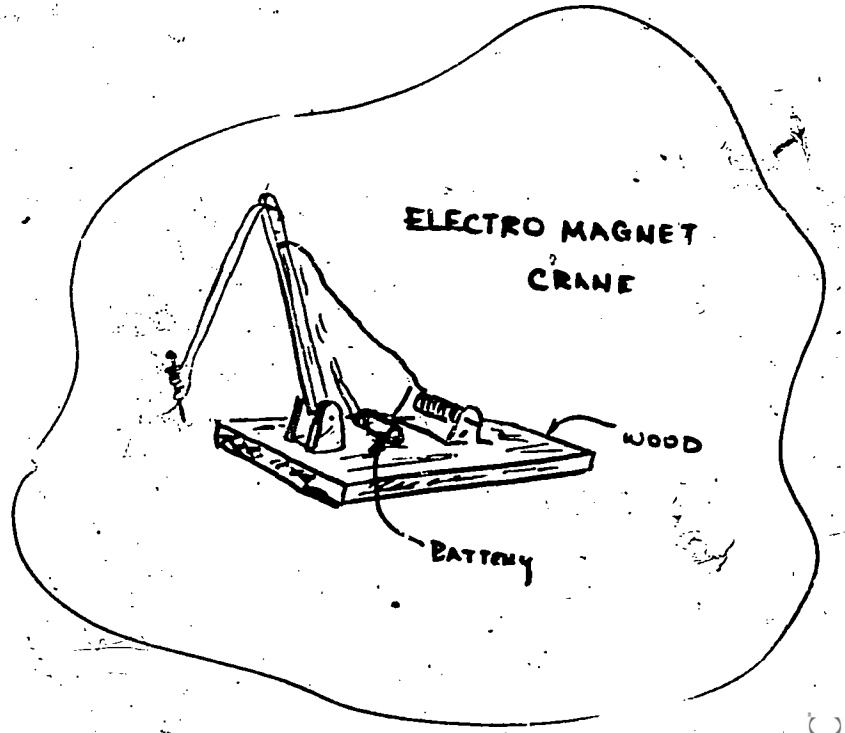
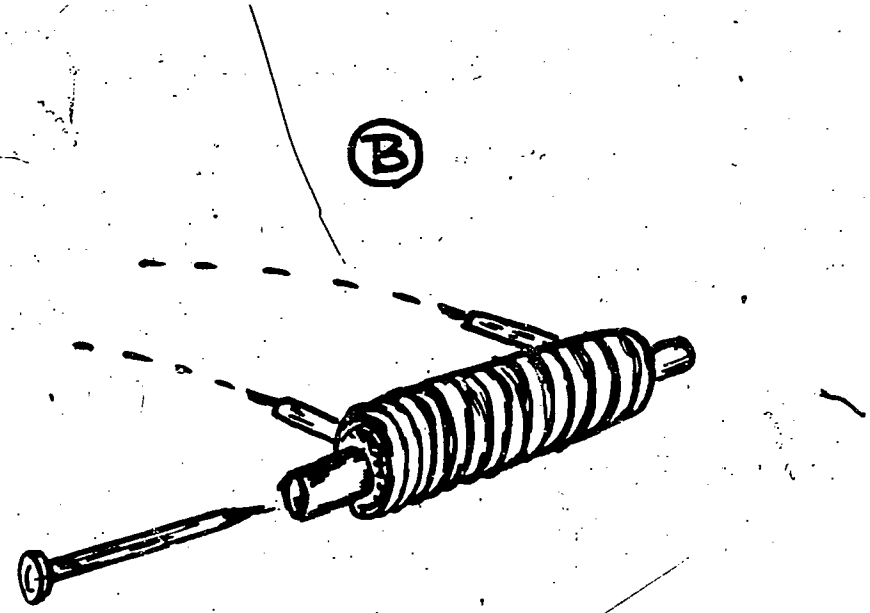


IDEA/PROBLEM

Simple and safe battery operated electrical devices can be easily arranged to produce motion. Make each one and compare the operation of each. Find out where these uses of electricity are at work in devices we often depend upon.



PROCEDURE:

A. An Electromagnet

1. Carefully wind 3 or 4 layers of insulated copper wire on an 8p-2½" nail. Allow enough wire to connect the wire coil through a switch to a battery.

2. Connect the wire coil to the switch and battery. Touch one end of the coil wrapped nail to paper clips, thumb tacks or small wire nails, then close the switch.

3. Arrange your electromagnet to pick-up or move things.

B. A Solenoid

1. Carefully wind 3 or 4 layers of insulated copper wire on a 2" length of soda straw. Allow enough wire to connect the wire coil through a switch to a battery.

2. Place an 8p-2½" nail half-way into one end of the straw. Connect the wire coil to the switch and battery. Close the switch.

MATERIALS AND EQUIPMENT

1 Battery-Switch combination
¼ lb. spool No. 20 insulated solid copper hookup wire
2 Plastic Drinking straws
1 pair Miller No. 100 wire stripper-cutter
2 8p-2½" common nail
Small steel nails or thumb tacks or pins or paper clips

FOLLOW-UP:

Arrange your electromagnet:

1. To make a noise.
2. To separate mixed steel and aluminum pins.
3. To move small steel objects without touching them.
4. To turn on a switch at a distant point.

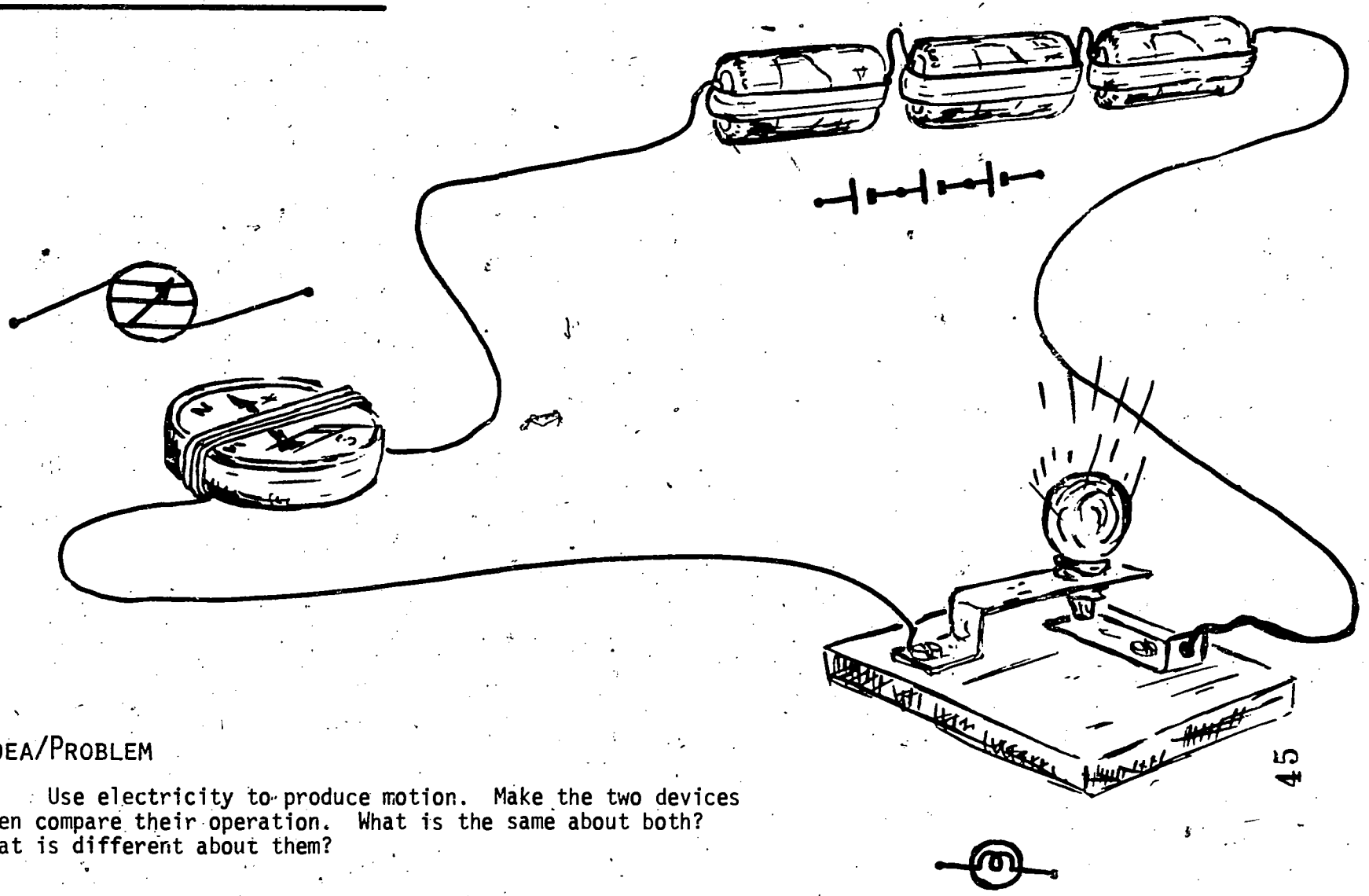
Arrange your solenoid:

1. To make a noise.
2. To move a marble
3. To turn on a switch

Compare the devices you have made.

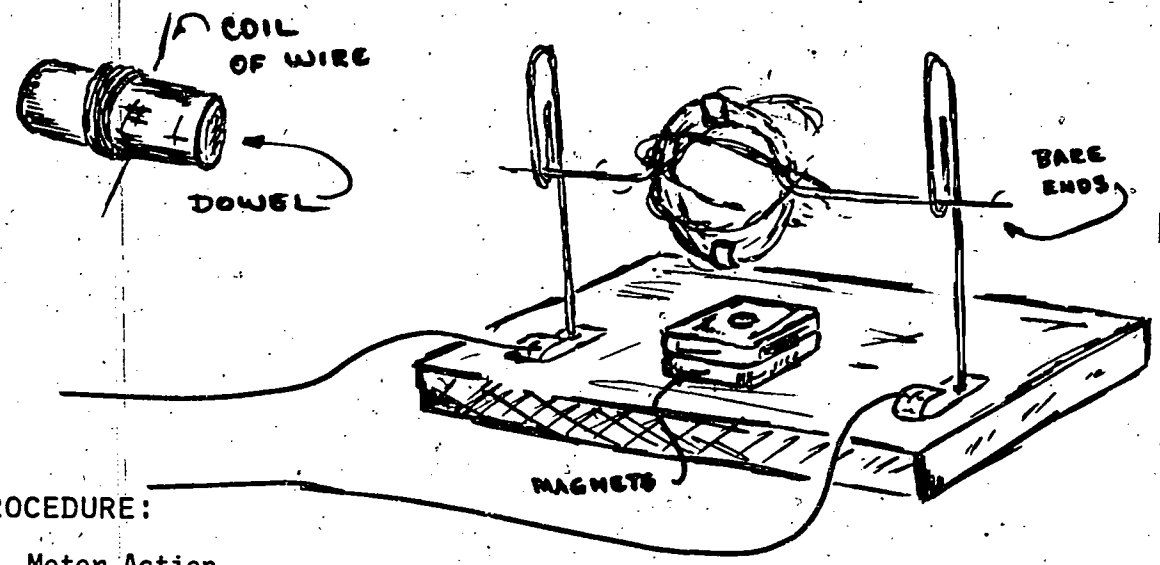
ELECTRICITY

MOTION



IDEA/PROBLEM

Use electricity to produce motion. Make the two devices then compare their operation. What is the same about both? What is different about them?



PROCEDURE:

A. Motor Action

1. Arrange the parts as shown in sketch A.
2. Hold a second magnetic compass near the coil wrapped compass and compare the action of each.
3. Remove the lamp from the circuit and alternately touch and open the two wires. Observe the action on the compass needle.

B. A Simple Motor*

1. Make a coil by winding 6 ft. of No. 26 magnet wire on the end of a tube as shown. Tape the coil so it will not unwind.
2. Scrape the insulation from both ends of the wire.
3. Carefully balance the coil by bending and aligning the two wire ends as shown
4. Place the balanced coil above the magnet as shown. Bend the paper clips so the coil is as close to the magnet as possible but free to turn. Connect a battery to the paper clips, then give the coil a light spin until it continues to run on its own.

* Elementary Science Study. Batteries and Bulbs II, Newton, Mass., E.S.S., Education Development Center, Inc., 1969.

MATERIALS AND EQUIPMENT

1 Battery-Switch combination
2 Magnetic compasses
1 No. 406 or 407 miniature screw base flasher lamp.
3 No. 82 rubber bands
1 ¼lb. spool No. 20 insulated solid copper wire
1 No. 100 Miller wire cutter-stripper
1 ¼lb. spool No. 26 insulated-enameled magnet wire
2 Paper clips
Masking tape
1 1/4" X 3/4" X 1" Ceramic magnet
1 Glass or plastic tube
1 pc. Tri-wall or wood ½" X 4" X 6"
1 Miniature lamp socket

FOLLOW-UP:

- How many devices can you list which operate with a motor? List them.
- What is the difference between a motor and an engine?

FOODS

How to Make Butter

Idea/Problem

Man's basic need for nourishment has made the gathering and processing of food a major occupation. He has tested many raw materials in local environments as a source of nourishment.

Apples, one of the first fruits man had in quantity, can be made into a favorite jamlike preserve such as "apple butter."

The peanut, an edible seed, usually two to a pod can be made into "peanut butter."

The processing of raw materials by students will be both pleasing to their palates and meaningful to their understandings of the food processing industries.

BUTTER

Procedure:

1. Put ¼ cup of whipping cream into a pint jar or blender.
2. Temperature common for churning is 50°.
3. Shake for a few minutes. What do you see?
4. Skim the surface with a knife and observe what is happening.
5. Pour off the butter fat - (buttermilk).
6. You may want to add salt to the butter before eating.

APPLE BUTTER

Butter can also be made from wild plum, wild grape and crab apple.

Procedure:

1. Wash carefully selected apples and cut them in quarters, leaving the skins on.
2. Put apples in pan and add enough water to cover half the apples.
3. Cook the apples until they are soft and the skins fall off.
4. Drain the cooked apples through a colander to separate the fruit from skins and seeds.
5. Measure the strained apples.
6. Add 1 cup of brown sugar to each 1½ cups apples. (You can use sorghum or honey to sweeten the apple butter)
7. Cook the sugar and apples until thick, add some cinnamon and ginger for flavoring.

PEANUT BUTTER

PROCEDURE:

1. Place raw peanuts into a covered pan and the pan on a hot plate. Set the heat to Lo or Medium.
2. Stir occasionally, and observe carefully being sure not to burn peanuts.
3. Remove the shells and thin paperlike husk.
4. After nuts are cooled and cleaned, place in a pan.
5. Sprinkle with salt, place on hot plate set at medium heat for a few minutes. (Note oil surfacing.)
6. Grind hot nuts with fine bladed food grinder. Note: Nuts may be ground while cold, but oil will be cool so the resulting peanut butter will be dry and of poor consistency.
7. Run the nuts through the grinder, as many as eight times, until desired texture is produced.
8. Place in deep bowl with approximately 1/3 as much water as finely ground nuts.
9. Beat with rotary beater until the nuts have absorbed the moisture and the peanut butter is of the right consistency.

HOW TO MAKE BUTTER

MATERIALS AND EQUIPMENT

Whipping cream
Salt
Raw Peanuts
Apples
Ginger
Cinnamon
Brown Sugar

Knife
Pint jar with cap
6 quart pan with cover
Colander
Set of measuring cups
Stainless mixing bowl
Food grinder
Hot plate
Rotary Food Beater

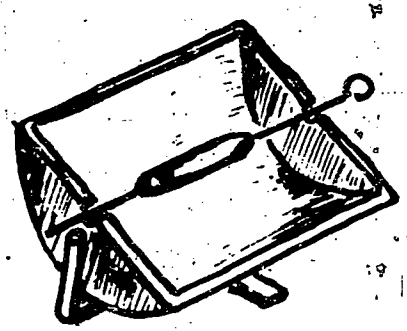
FOLLOW-UP:

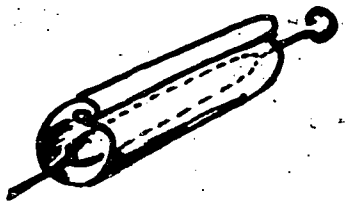
- Investigate flavoring of butter.
- Try other raw materials to make butter with.
- Study the career opportunities within the food industry.

SOLAR COOKER

IDEA/PROBLEM

The use of an energy which is safely concentrated on a skewer with food wrapped in solar foil will give students a better understanding of the sun's rays.





PROCEDURE:

1. Inspect the solar cooker to determine how it is used.
2. Place food on skewer and wrap it with the foil, black side out. Fold top and side edges tightly to avoid dripping.
3. Place skewer so foil seam is as near to top as possible.
4. Focus the cooker unit until the pinpoint of light shining through the hole in tracking cell falls on center of red target.
5. Cooking time is about 10-15 minutes for high sun. Cooker should be refocused periodically.

Note: Use only solar foil. Ordinary cooking foil will not work.

MATERIALS AND EQUIPMENT

Hot Dogs
Bratwurst
Hot dog rolls
Chopped onions
Vinegar
Relish

Solar Cooker - Edmund Scientific Co.
Paper Plates
Fork
Knife
Solar Foil - Edmund Scientific Co.

FOLLOW-UP:

- Investigate other uses of solar energy.
- Have students experiment in developing recipes.
- How large of an industry has been developed with solar energy?

SOMETHING DIFFERENT

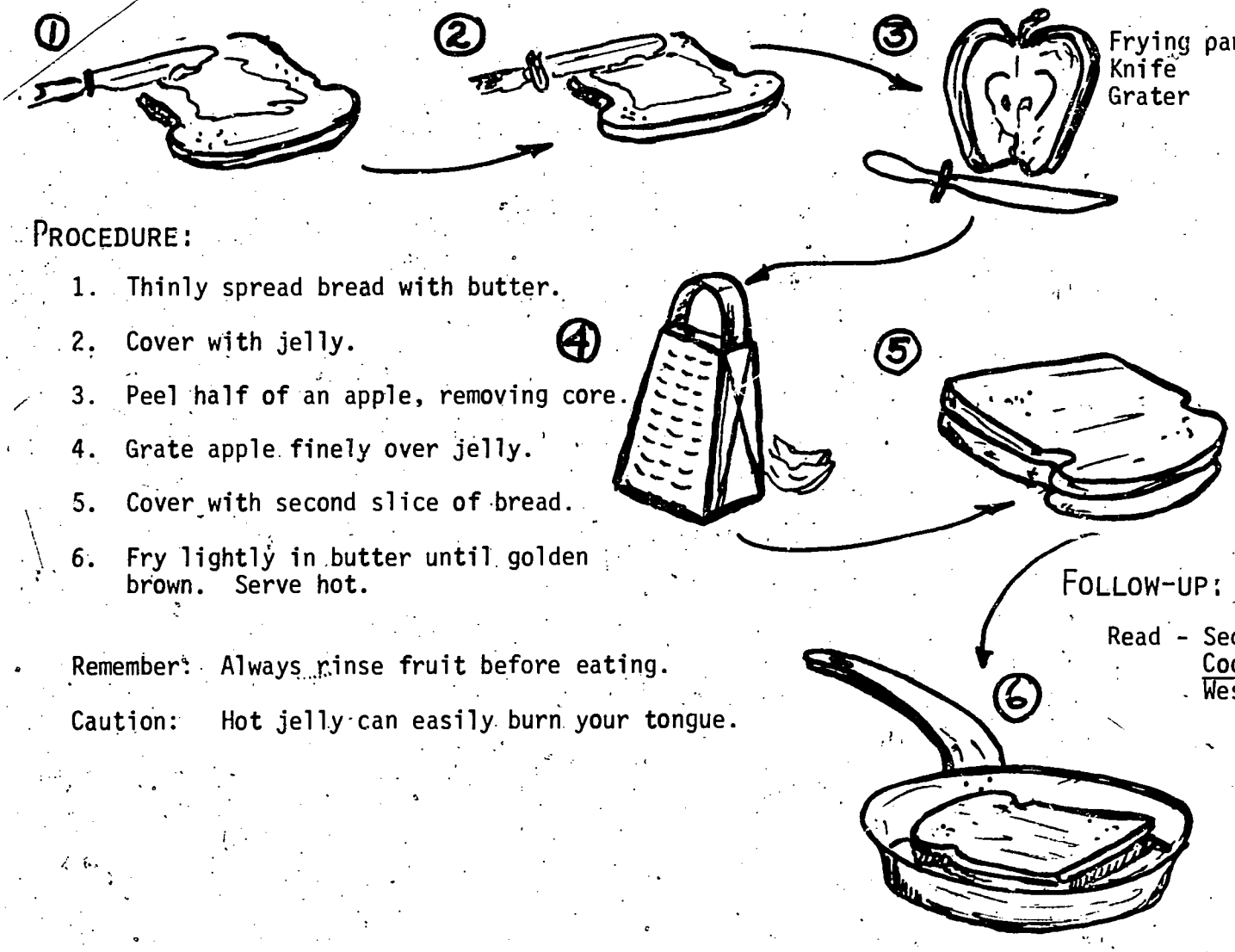
IDEA/PROBLEM

Fruit is considered instant food. However, children will enjoy experimenting and developing this F.F.S. - (Fruit Fried Sandwich)

MATERIALS AND EQUIPMENT

Bread - 2 slices
Apple - ½ of an eating apple
Jelly - grape or other
Butter

Frying pan
Knife
Grater



PROCEDURE:

1. Thinly spread bread with butter.
2. Cover with jelly.
3. Peel half of an apple, removing core.
4. Grate apple finely over jelly.
5. Cover with second slice of bread.
6. Fry lightly in butter until golden brown. Serve hot.

Remember: Always rinse fruit before eating.

Caution: Hot jelly can easily burn your tongue.

FOLLOW-UP:

Read - Sedgwick, Ursula. My Learn To Cook Book. Racine, Wisconsin, Western Publishing Co., Inc.

TASTE PREFERENCE TESTING

IDEA/PROBLEM

Conduct a taste preference survey. Determine preference for vegetable and fruit juices on taste alone. Then, compare taste preference with unit cost.

PROCEDURE:

1. Arrange the materials to conduct a taste preference survey.
2. Set up samples without allowing others to see the cans of juices. Use small graduated plastic cups.
3. Pour out 5 ml. or 5 cc. samples of each juice. Mark them:
   Apple Juice A, B, C
   Tomato Juice D, E, F, G.
4. Invite six participants to take part in a taste preference survey.
5. Three people might sample apple juice and three might sample tomato juice, or, the six might sample all seven juices.
6. Ask each to give an opinion by ranking the juices first choice, second, third, etc. by taste preference alone.
7. Record the results.
8. Graphically display your survey results.
9. Inform everyone of the brand name preference and prices only after all who wish to participate have done so.

MATERIALS AND EQUIPMENT

Three brands canned apple juice - 5½ oz. size
Four brands canned tomato juice - 5½ oz. size
Graduated plastic cups-Metric
¼" graph paper
Index cards
Magic markers
Masking tape
Pencils

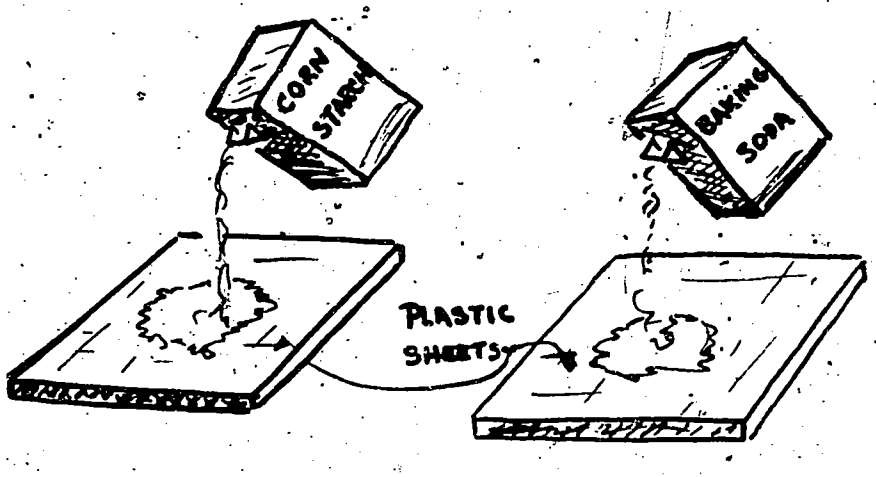
FOLLOW-UP:

- Was there agreement of preference brand?
- How did marked price correspond to taste preference?

TESTING FOODS FOR STARCH

IDEA/PROBLEM

Student will be able to have a better understanding of nutrients through a simple method for the identification of a major food nutrient.



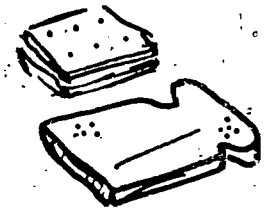
PROCEDURE:

1. Dust cornstarch over a piece of plastic.
2. Dust baking soda over another piece of plastic.
3. Drop a drop of iodine over each.
4. Compare. Purple indicates starch.
5. Try with a potato, an apple, a slice of bread and a cracker.
6. What have your found out?

MATERIALS AND EQUIPMENT

Cornstarch
Baking Soda
Iodine
Apple
Slice of bread
Cracker
Potato

Plastic sheet (Slicing board)
Knife

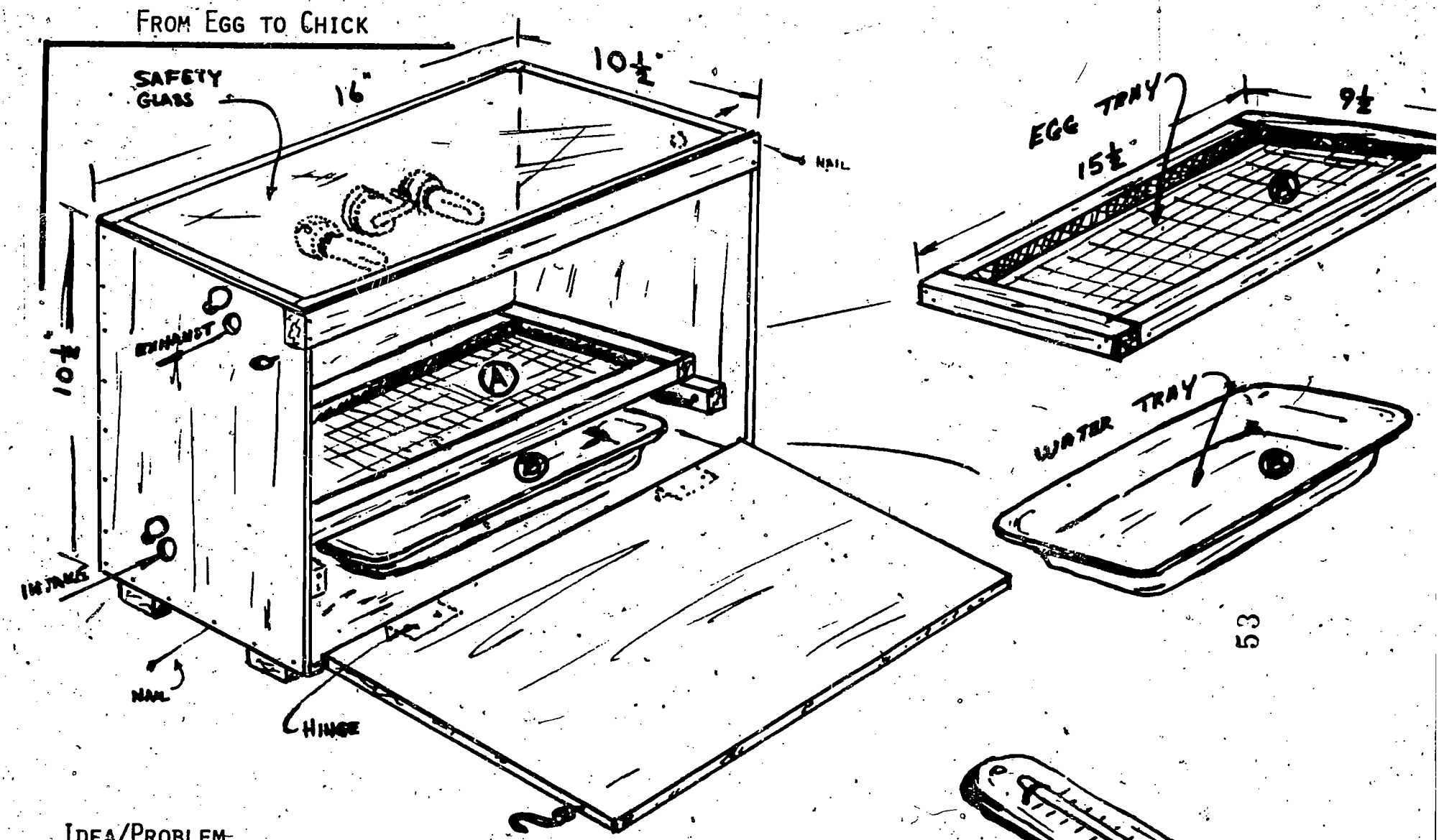


FOLLOW-UP:

- You may want to test foods for sugar, fat and protein.
- What values to man are these major food groupings?

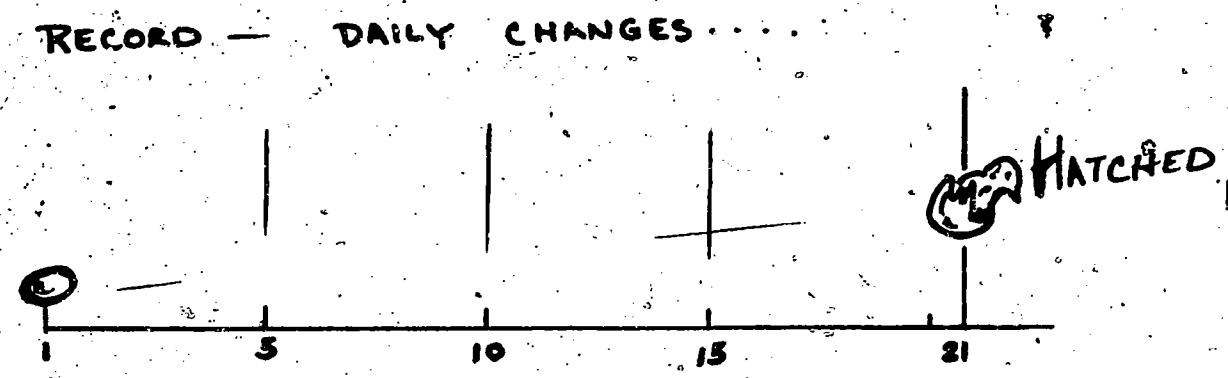
INCUBATOR

FROM EGG TO CHICK



IDEA/PROBLEM

The hatching of chicks is an ancient art that has developed into a rather exact science. Children can develop a mechanical incubator which will serve as a scientific tool. With a few dozen eggs, children will be able to discover how a living system develops.



PROCEDURE:

1. Select materials and construct incubator - (see illustration)
2. Things to consider:

Heat	. Try to maintain a temperature of 42°C to 43°C (102°F - 103°F) . Source of heat can be two 40 watt bulbs . Thermostats can be purchased from (see supplier list)
Ventilation	. Four openings 3/4" diameter for vents. Exhaust - top, intake - bottom
Humidity	. Shallow cookie pan used as water-holding reservoir for humidity. Sponge placed in pan will result in more surface area for evaporation
Top for Observation	. Safety glass or plastic may be used. Edges should be covered with cloth tape eliminating cuts . Weather stripping can be placed on top edges to prevent heat loss
Location	. Keep incubator in a room where temperature is between 20°C-25°C (70°F-75°F). Do not place unit near windows-avoid direct exposure to sun rays.

INCUBATOR

FROM EGG TO CHICK

MATERIALS AND EQUIPMENT

Hatching eggs - (purchased from any poultry breeding farm)
2 Eye hooks
2 pair ½" X ½" X 2" hinges
½" Waterproof plywood
3/4" X 1 1/2" X 6" firing
Sheet safety glass
¼" X ½" wire mesh

Heating source from:
American Lincoln Incubator Co.
591 Somerset Street
Somerset, New Jersey

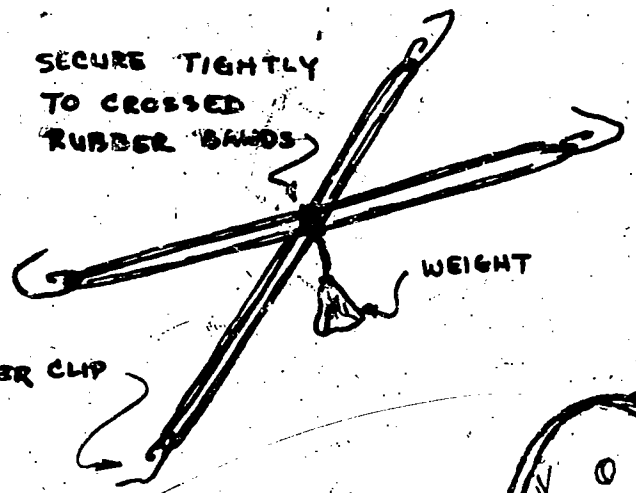
Thermostat
Thermometer
Water tight container
Tape
Two 40 watt bulbs
Hammer, nails
Pliers, screw driver
Ruler
Metal cutters
Saw

FOLLOW-UP:

Read - 4-H Science Guide From Egg to Chick Incubators and Their Operations. New Brunswick, New Jersey, Cooperative Extension Service, Rutgers University, 1973.

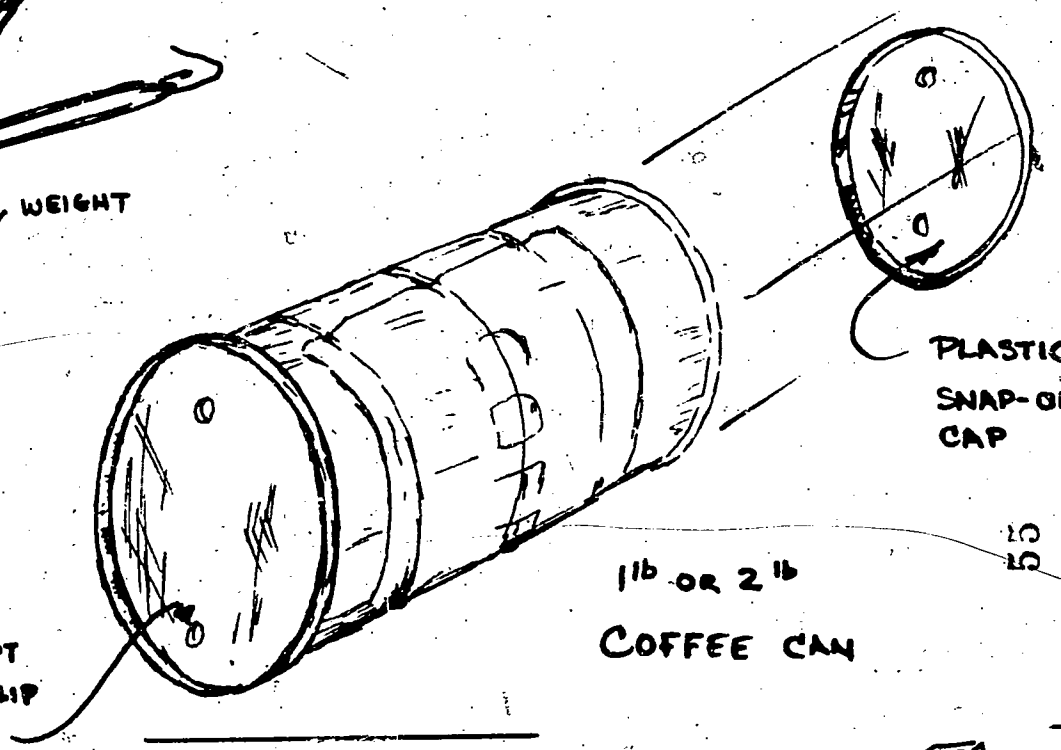
INERTIA

#1



SUSPEND A SMALL HEAVY BOLT, NUT, WASHERS OR FISHING SINKER FROM CENTER OF CROSSED RUBBER BANDS

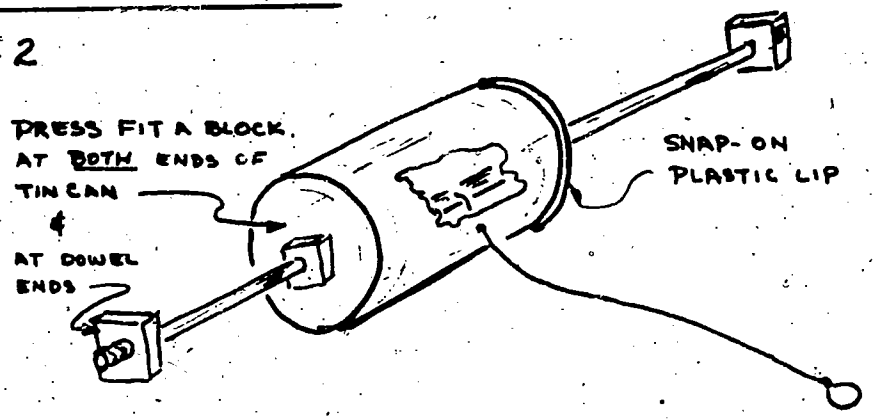
AS CAN IS ROLLED THE SUSPENDED WEIGHT WILL REMAIN STATIONARY AND WIND-UP THE CROSSED RUBBER BANDS



IDEA/PROBLEM

Arrange these common materials to illustrate Newton's First Law of Motion.

#2



"A body which is at rest will remain at rest; and a body which is in motion will remain in motion at the same speed and in the same direction, unless acted upon by some unbalanced force."

Newton's First Law of Motion

PROCEDURE:

Prepare the tin cans with plastic snap lids as shown.

For No. 1

1. Secure the weight to the crossed rubber bands.
2. The rubber bands should twist together and wind up as the can is rolled.
3. Roll the can across the floor. It should roll back.
4. Try to make the can roll up an incline.

For No. 2

1. Thread the cord through the hole in the side of the can. Then, tie it thru the hole in the rod.
2. Press on the wooden blocks. You may need to glue them in place to the rod.
3. Wind up the cord on the rod so that only enough to hold onto is outside the can.
4. Pull the cord hard - then release your pull to allow the cord to wind up on the spinning rod.
5. Your pull-and-release on the cord with the winding and unwinding of the cord on the rod should keep the rod spinning.

INERTIA

MATERIALS AND EQUIPMENT

- 1 2 lb. coffee can with plastic lid
- 1 32 oz. juice can and plastic lid
- 4 Paper clips
- 2 Rubber bands 3" or 4" size
- 1 Nail to punch holes in can
- 1 Short heavy bolt or nut or fishing sinker-weight
- 1 3" pc. wire or string to attach weight securely to crossed rubber bands
- 1 ½" Dowel rod
- 1 pc. heavy cord or twine
- 2 pcs. wood 3/4" X 2" X 2" with 1/2" hole drilled through the center
- 1 ½" drill bit
- 1 Hand drill

FOLLOW-UP:

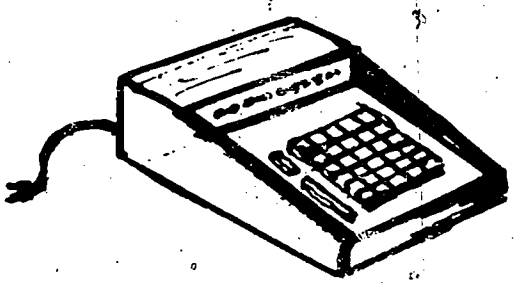
- Try putting heavier weights on the ends of the rod in No. 2. What difference does this make in the action?
- Where do you see things that work like these tin can devices?
- Try to invent a use for your tin can inertia devices.

MATHEMATICS

CALCULATORS

IDEA/PROBLEM

The calculator is basically an electronic device capable of manipulating bits of information at very fast speeds. Students will be able to perform meaningful tasks with this equipment and receive knowledge of basic arithmetic.



PROCEDURE:

1. Examine the machine.
2. Read over and understand general instructions.
3. Start with basic calculations register.
4. Perform very simple problems at first - addition, subtraction, etc.
5. Try memory register.
6. Develop some of your own problems.

MATERIALS AND EQUIPMENT

Paper
Pencil

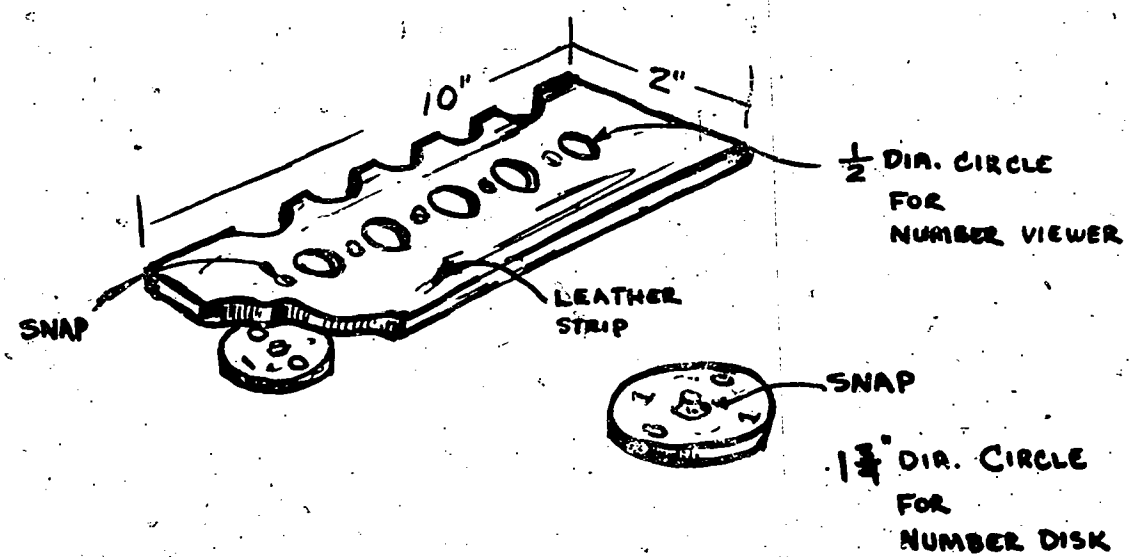
Electronic calculator

FOLLOW-UP:

- In what way have electronic devices influenced our lives.
- Can you do calculations in binary arithmetic?
- Investigate career opportunities within electronic industry.

IDEA/PROBLEM

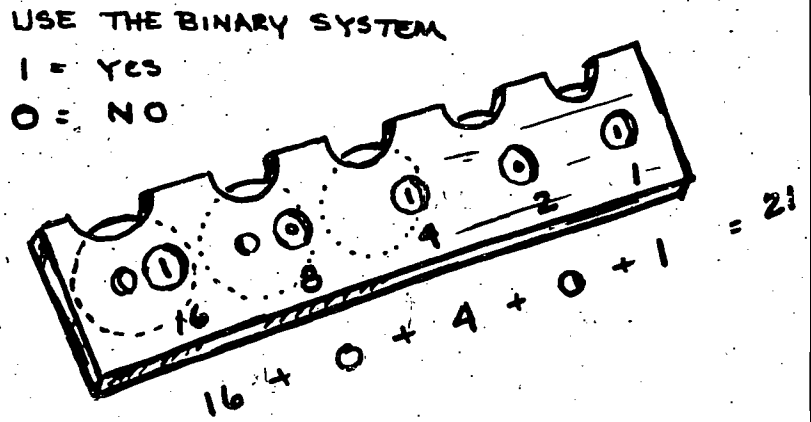
By the development of a Binary computer, the student will be able to have a more meaningful experience and awareness with mathematical concepts.



PROCEDURE:

1. Cut leather to desired measurements.
2. Mark snap locations and attach snaps to leather.
3. Assemble computer parts.
4. Rotate circle checking snaps - use a fine point felt pen to write numerals.
5. Work out a simple problem.

CALCULATORS - BINARY



MATERIALS AND EQUIPMENT

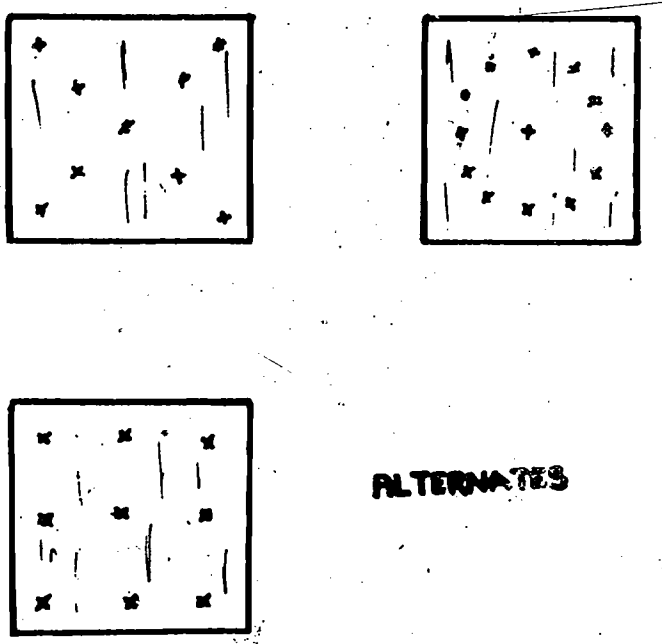
Strip of leather
Snaps
Leather dye
Wool daubers

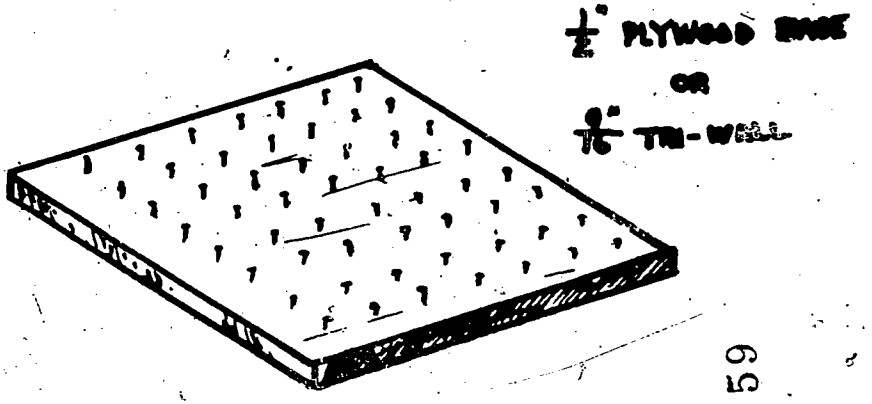
Mallet
Knife
Snap setter
Round drive Punch-½" diameter

FOLLOW-UP:

- Have students develop their own calculator designs (other materials may be used).
- Try to use this design concept with language arts - (spelling, etc.)

GEOBOARDS

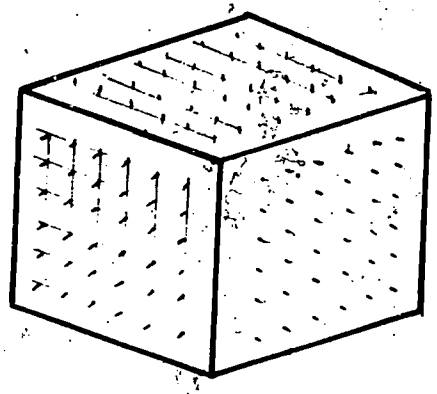




IDEA/PROBLEM

Build a geoboard and use it to show and change lines, angles, spaces, shapes and their relationships.

TRY
BUILDING A GEO CUBE



PROCEDURE:

1. Look over the various alternatives.
2. If possible, secure both booklets mentioned.
3. Decide on a board arrangement, then layout and prepare a board.
4. Suggestions:
   - Use 1/2", 3/4" or 1" No. 16 or No. 18 brads
   - Colored rubber bands are helpful in pattern visualization
   - Allow a minimum of 1" between brads
   - For laying out pin locations, ¼", ½" or 1" graph paper is helpful.

GEOBOARDS

MATERIALS AND EQUIPMENT

9/16" Tri-wall
1/2" Plywood
1/2"-3/4"-1" No. 18 wire brads
Pencil
Rubber band assortment - colored
Graph paper
Abrasive paper 2/0

Claw Hammer
Crosscut Saw
12" Combination Square

Booklets: Geoboard Geometry by Galeb Gattegno, Cuisenaire Co. of America, Inc., 1968.

Geoboard Geometry by Margaret A. Farrell, Creative Publications, 1971.

FOLLOW-UP:

- Develop regular geometric shapes and show their relationships in graph form, i.e., sides and area.
- Show fractions of large shapes with different color rubber bands.
- Form all the squares and all the right-angled triangles possible on your geoboards.

MATHEMATICS

MATH MATERIALS

IDEA/PROBLEM

Changes in mathematics constitute much more than a fad. Therefore, it is appropriate to relate instruction more closely to knowledge of how students learn, hence the emphasis upon meaning, discovery, patterns of relationship, beginning with free exploration and gradually moving to externally guided work.

PROCEDURE:

1. Select one of the items (cuisenaire rods, etc.) and familiarize yourself with it.
2. What does it do, or show, or help explain?
3. When you can successfully solve one problem, share what you discovered with someonw else.

MATERIALS AND EQUIPMENT

1/8", 1/4", 1/2" graph paper
Pencils

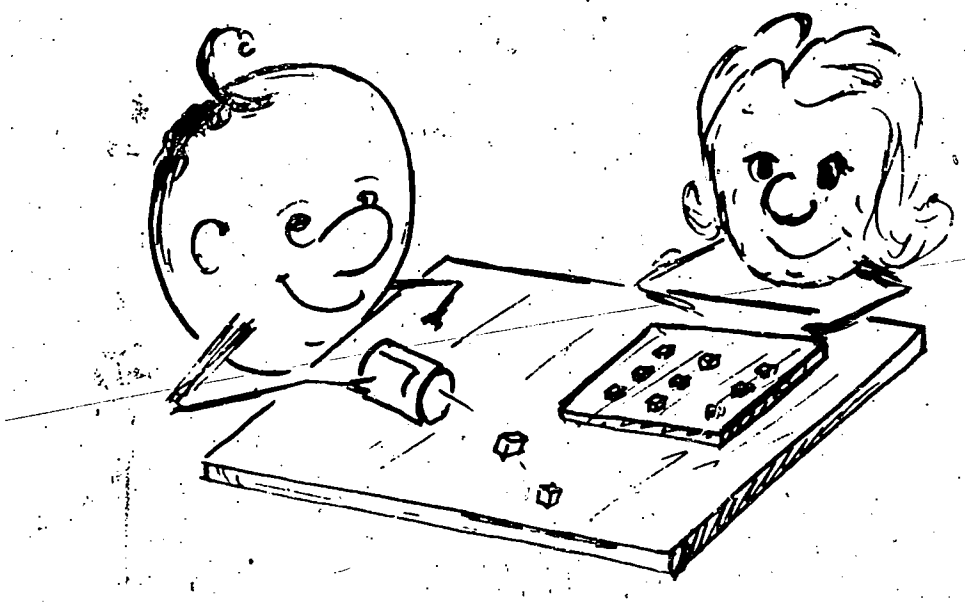
M.A.B. blocks and cards
Cuisenaire rods
Multiplying machine
SEE Slide Rule
Magic Adder
Invicta Balance
Osmiroid Tocker Timer
Colored Cubes
Sum Stick
Trundle wheel
Booklets on the above

FOLLOW-UP:

- Show a relationship i.e., number of men to number of woman present with colored cubes.
- Time a marble roll with the tocker timers.
- Measure the room you are in using any non-standardized tool. Represent the results in some way.

IDEA/PROBLEM

Mathematical concepts can be enhanced with guided exploration via "games."



PROCEDURE:

1. Select a game or math material.
2. Find out how it is played or what it does or shows or helps explain. Share your understandings with someone else.
3. Make a graph of wins, losses and related results. Share them with the class.

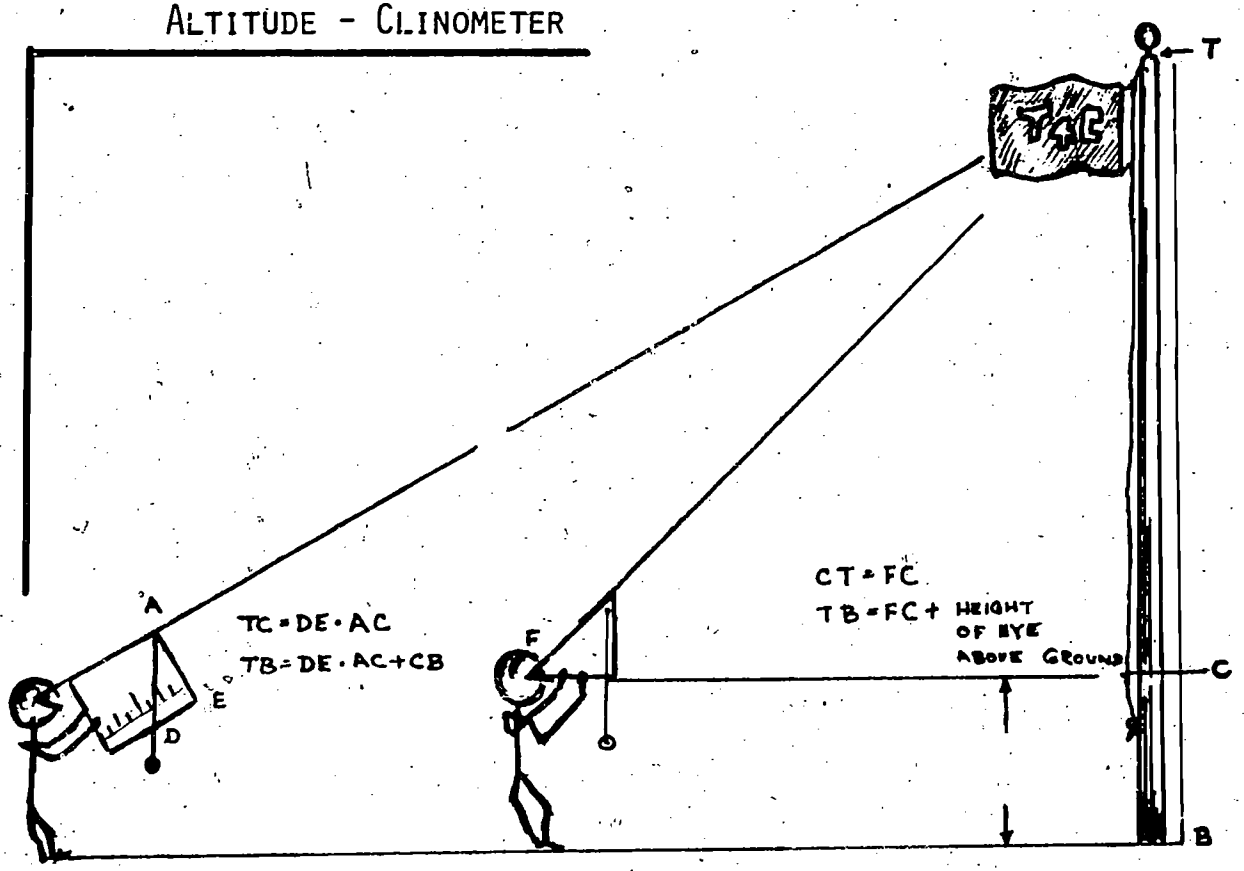
MATERIALS AND EQUIPMENT

Mirror Cards and Teacher's Guide
WHAT'S MISSING LOTTO
WFF'N PROOF
TUF
ATTRIBUTE GAMES AND PROBLEMS
HEADS UP
3D TIC-TAC-TOE
SOMA CUBES
YAHTZEE
Set of Dice
Deck of Playing Cards
Set of colored wooden cubes
KALAH
TANGRAMS
Pattern Blocks
Geo Blocks
SAM activity cards (SEL)

FOLLOW-UP:

- Have children experiment with other games.
- Investigate ideas children may have in developing a class math game.

ALTITUDE - CLINOMETER



IDEA/PROBLEM

Guess the height of various objects outdoors. Record the guesses then construct an instrument to measure heights. How close were estimates to measured heights?

USING THE TRIANGLE SHAPED CLINOMETER

* Walk a distance from the object to be measured until its top can just be seen along the sighting straw and the weighted string is in line with the dotted line shown on the detailed drawing on Page 61.
* Now pace off the distance to the object - F C. Add height C B to the paced distance and you have the height of the object.

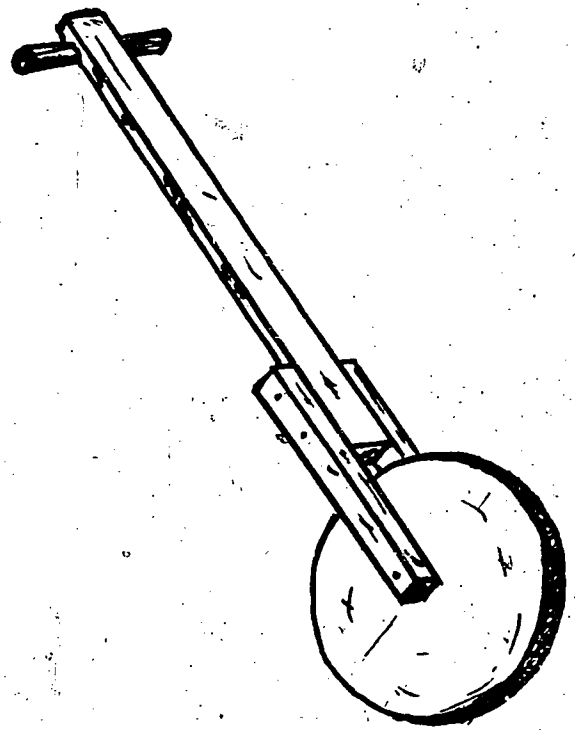
USING THE SQUARE SHAPED CLINOMETER

* Sight along the straw to the top of the object. Hold this position until the weighted string stops swinging.
* Press the string to the number line and read the number between 0.0 and 1.0 or distance D E.
* Measure the distance to the base of the object. Multiply distance D E times the distance to the object A C and add height C B.

MATERIALS AND EQUIPMENT

1/2" or 3/4" ext. plywood
1/2" or 3/4" dowel or 3/4" X 1½" pine
Machine bolt, nut
Lock and flat washer for axle
Pencil
Graph paper

Dremel Saw
Sabre Saw
Hand Saw
Hand Drill - 1/8", 1/4" 5/16" bits
Claw Hammer
Screw Driver
Compass
Trammel points



PROCEDURE:

1. Decide on a metric or english unit or build and compare both.
2. Determine the size of your wheel. Select 1/2" or 3/4" exterior plywood for the wheel.
3. Layout and cutout the wheel.
4. Design, build and attach a means for holding and controlling the wheel.
5. Check the accuracy of your wheel, correct circumference if necessary.

FOLLOW-UP:

- Find: Length of the room.
  Width of the room.
  Length of the building.
  Length of building property.
- Show all the above length relationships in graph form.
- Investigate other devices for linear measurement.

MEASUREMENT

PERSONAL

IDEA/PROBLEM

Children will be able to develop an awareness of themselves in a measureable way through the observing of growth and physical factors.

PROCEDURE:

1. Develop a personal log and maintain it weekly, monthly, quarterly.
2. Find your own measurements:

Head size	Weight
Neck	Reach
Waist	Shoe
Height	

MATERIALS AND EQUIPMENT

Meter stick
Yard stick
Bath scale
Paper
String
Paper and pencil
Scissors
Conversion table for Metric/English systems

FOLLOW-UP:

- Interpret measurements in metric units.
- Develop performance records. How far can you throw a ball, jump, etc.

MEASUREMENT

PERSONAL PACE SCALE

IDEA/PROBLEM

Determine your own personal pace. Then, use it whenever approximate distances are needed when you measure things.

MATERIALS AND EQUIPMENT

1 Tape measure to layout a fixed distance
2 Objects to mark pace course

PROCEDURE:

Use your own body to measure distances.

1. Set up a 100 ft. pace course. Mark each end of the course with an object.

2. With your natural stride, walk off the distance four or five times. Count, consecutively, each time the same foot comes down.

3. Average your trials to determine your personal pace distance.

Example:

Trial 1	25 Paces	
Trial 2	24 Paces	
Trial 3	22 Paces	24 Paces
Trial 4	26 Paces	5 120
Trial 5	23 Paces	10
	120	20

Average example pace = 24 for 100 feet.

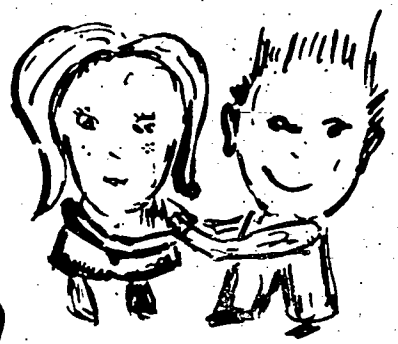
4. Now, go out and measure buildings, sidewalks, houses, cars, etc., using only your pace.

FOLLOW-UP:

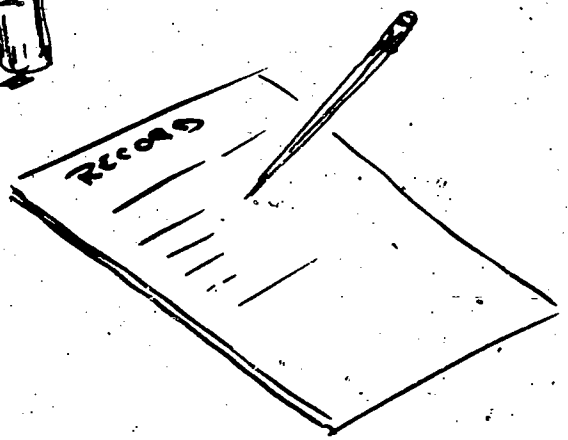
- Compare your pace with others. Make a chart showing each person's paces for 100 feet.
- Why is this method of measuring only approximate?

MEASUREMENT

PULSE RATE



MEASURE
PULSE
RATE



EXERCISE

UP – RIGHT FOOT
DOWN RIGHT
UP LEFT
DOWN LEFT
UP R...
...WN RIGHT
... LEFT
...

20 SECOND
INTERVALS

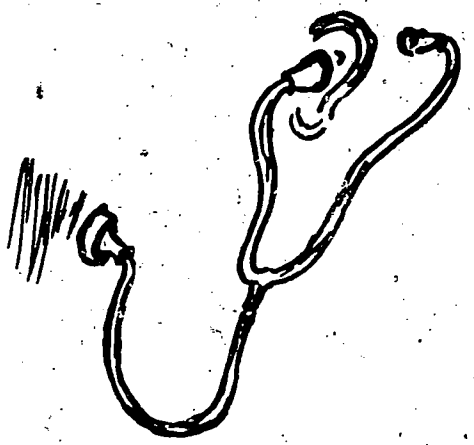
IDEA/PROBLEM

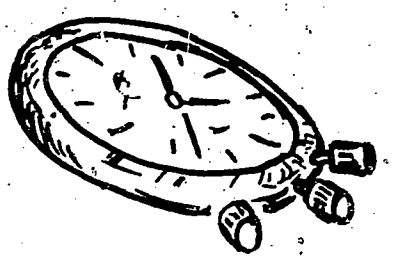
How long does it take your pulse rate to return to normal after a given exercise?

PULSE RATE

MATERIALS AND EQUIPMENT

Graph paper
Pencils, felt tip pens
1 Stop watch with sweep second hand
1 Stethoscope
1 Low stool or sturdy box





PROCEDURE:

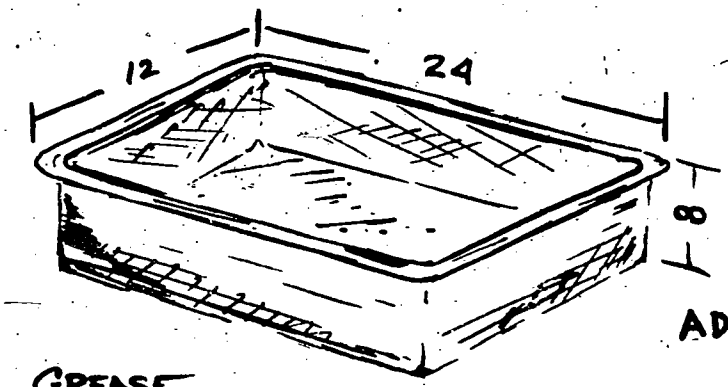
1. Select a partner. Measure each other's pulse rate and record it.
2. Take turns doing a light exercise, then record each other's pulse rate immediately after exercise.
   Example: Using a low sturdy box or stool - up left foot, then right foot; down left foot, then down right foot.
3. Then, record pulse rate at 20 second intervals for 10 seconds.
4. Chart your results with different exercises.

FOLLOW-UP:

- Keep weekly records of your own pulse rate after a given exercise. What similarities or differences do you observe over time?
- Do each of us have the same at rest pulse rate?
- Keep records of height and weight change for yourself over time.

THINK METRIC!

TRY A "KILOGRAM" CAKE



GREASE
AND
LINE WITH PAPER.

24 x 12 x 8 CENTIMETER LOAF PAN
(9" x 5" x 3")

ADD:

SIFT TOGETHER INTO BOWL

		APPROXIMATE
	½ KILOGRAM FLOUR	(2¼ cups)
	¼ KILOGRAM SUGAR	(1 cup)
	10 GRAMS BAKING POWER	(2 Tsp)
	5 GRAMS SALT	(1 Tsp)

ADD:

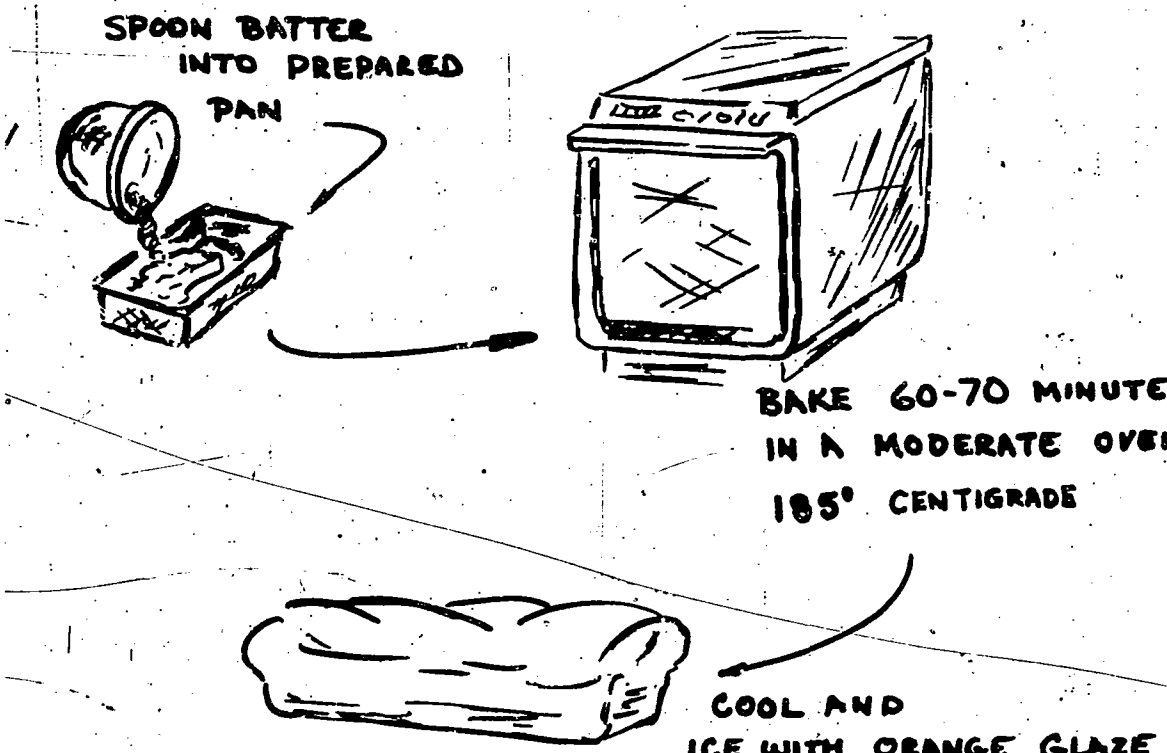
	⅛ KILOGRAM SOFT SHORTENING	(½ cup)
	5 MILLILITERS VANILLA	(Tsp)
	5 EGG YOLKS	
	110 MILLILITERS MILK	(½ Tsp)

BEAT TWO MINUTES THEN ADD:

	55 MILLILITERS OF MILK	(¼ cup)

IDEA/PROBLEM

Use the metric system of measurement exclusively for a month or longer. The Procedure and Materials-Equipment lists suggest a way to begin. The KILOGRAM CAKE diagrams give another one of many ways to begin.



MEASUREMENT

THINK METRIC!

MATERIALS AND EQUIPMENT

- 1/10"-1/8"-1/4"-1/2"-1" Graph paper
  Pencils, Felt pens
  Paper clips, strips of paper, clay, card or index stock, wire, scraps of ribbon, tin cans, paper cups, wood for making measuring tools.
  National Bureau of Standards Publication No. 232-The Metric System of Measurement. U.S. Government printing office
  Meter stick
  Metric and English trundle wheels
  Platform gram scale to 5000 gms.
  Spring gram scale to 250 gms.
  Liter, Milliliter containers
  U.S.A. "Goes Metric" Swani Publishing Company, Box 248, Roscoe, Illinois 61073

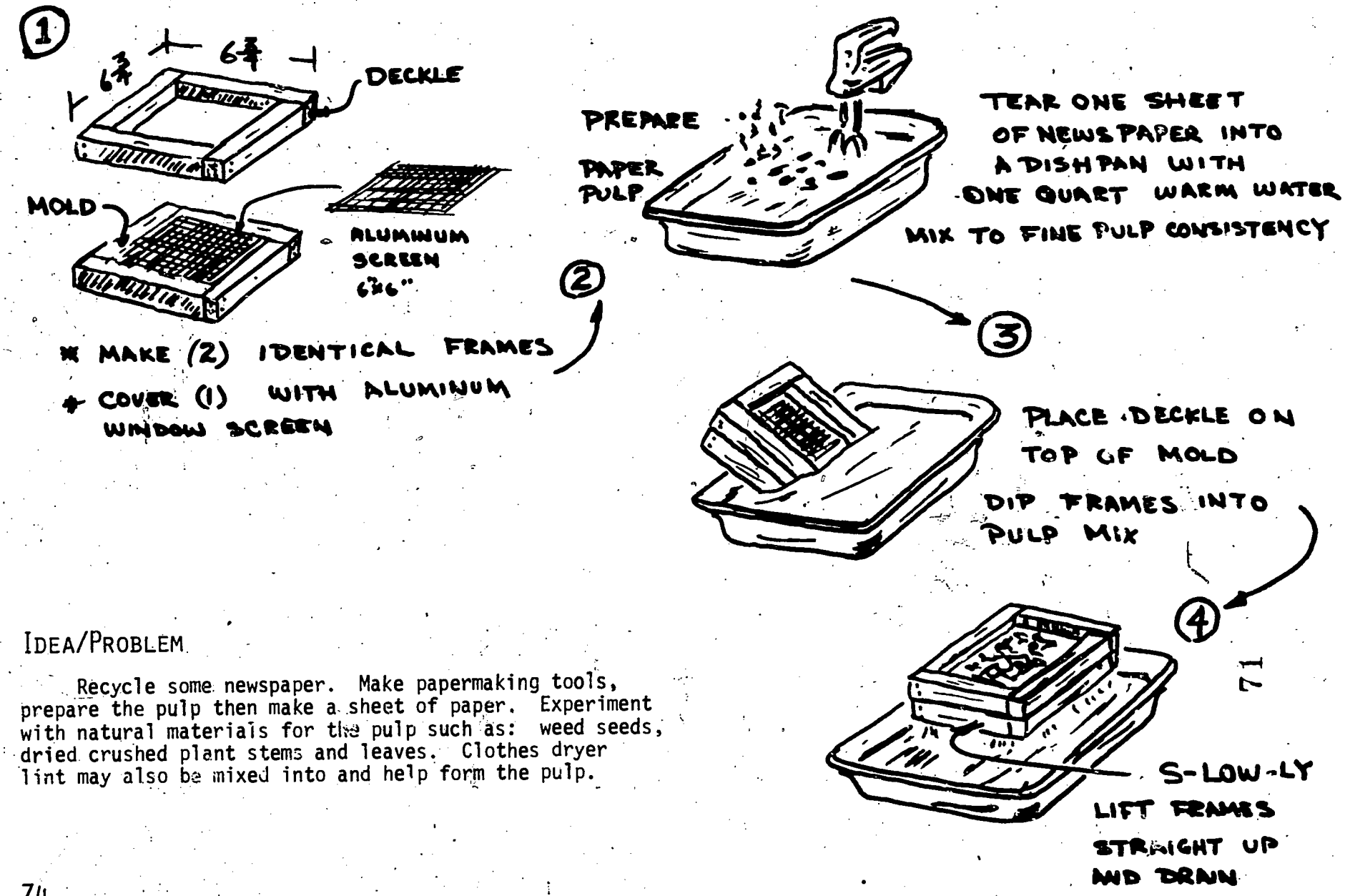
PROCEDURE:

1. Measure and record class vital statistics in metric units, i.e., weight, height, reach - both arms, waist, palm width, foot length, head size, etc.
2. Make your own metric measuring tools for measuring round objects such as tin cans, balls, cups, pens, etc.
3. Measure your room and its contents in metric units.
4. Describe the size of trees, automobiles, bicycles, rugs, chairs, tables, books, paper, newspapers, etc. in metric units.
5. Similarly, describe the weight of common objects in metric units.

FOLLOW-UP:

- Find out how many products list size or quantity in Metric and English units.
- What are the advantages and/or disadvantages of the Metric System? The English System?
- Build something using only metric units. Describe and explain it to a friend.

RECYCLING

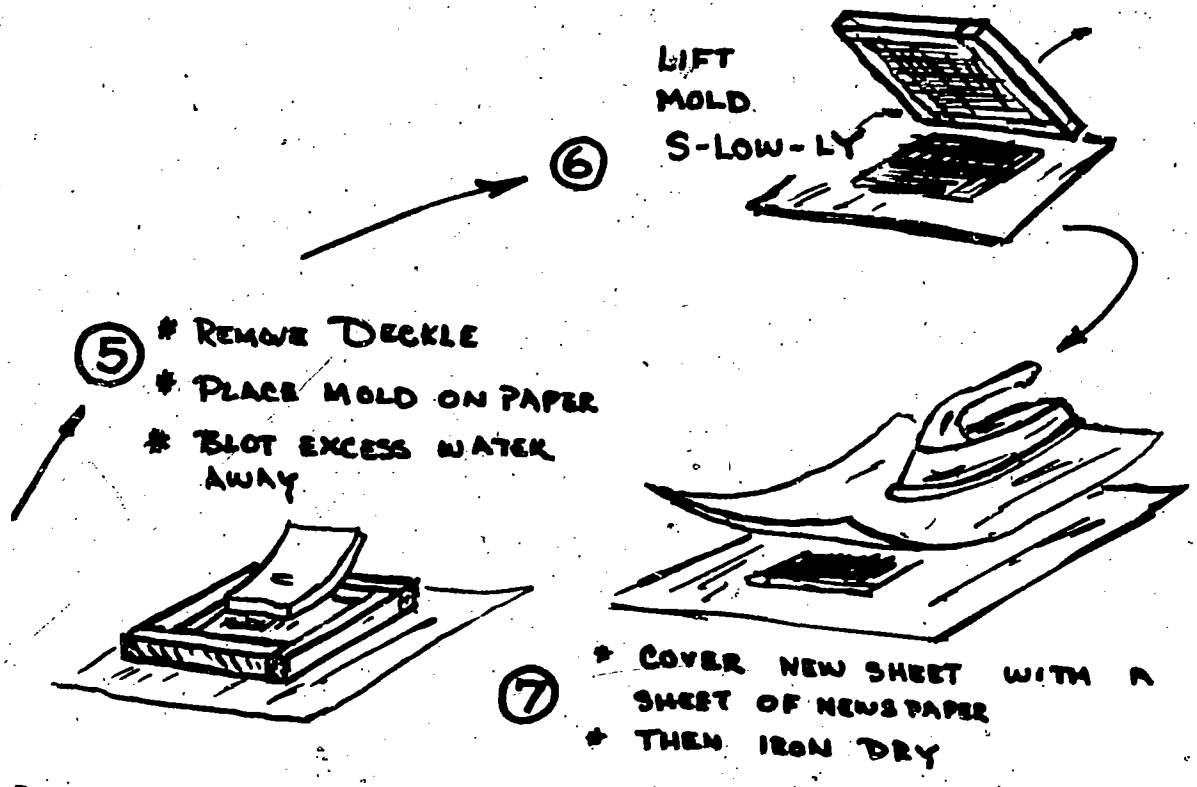


IDEA/PROBLEM

Recycle some newspaper. Make papermaking tools, prepare the pulp then make a sheet of paper. Experiment with natural materials for the pulp such as: weed seeds, dried crushed plant stems and leaves. Clothes dryer lint may also be mixed into and help form the pulp.

PAPER

RECYCLING



MATERIALS AND EQUIPMENT

8 pieces 1/2" X 3/4" X 6" soft wood
1 piece 6" X 6" aluminum window screen
Scrap newspaper
Water
1 Staple gun
1 Box staples
1 Electric clothes iron
1 Hand or electric mixer
2 Sponges
1 Plastic dishpan
1 Grounded extension cord
1 Rubber stamp lettering set
1 Typewriter
1 Pair scissors
Pencils
Felt tip pens
Booklets: Hammermill Paper Company

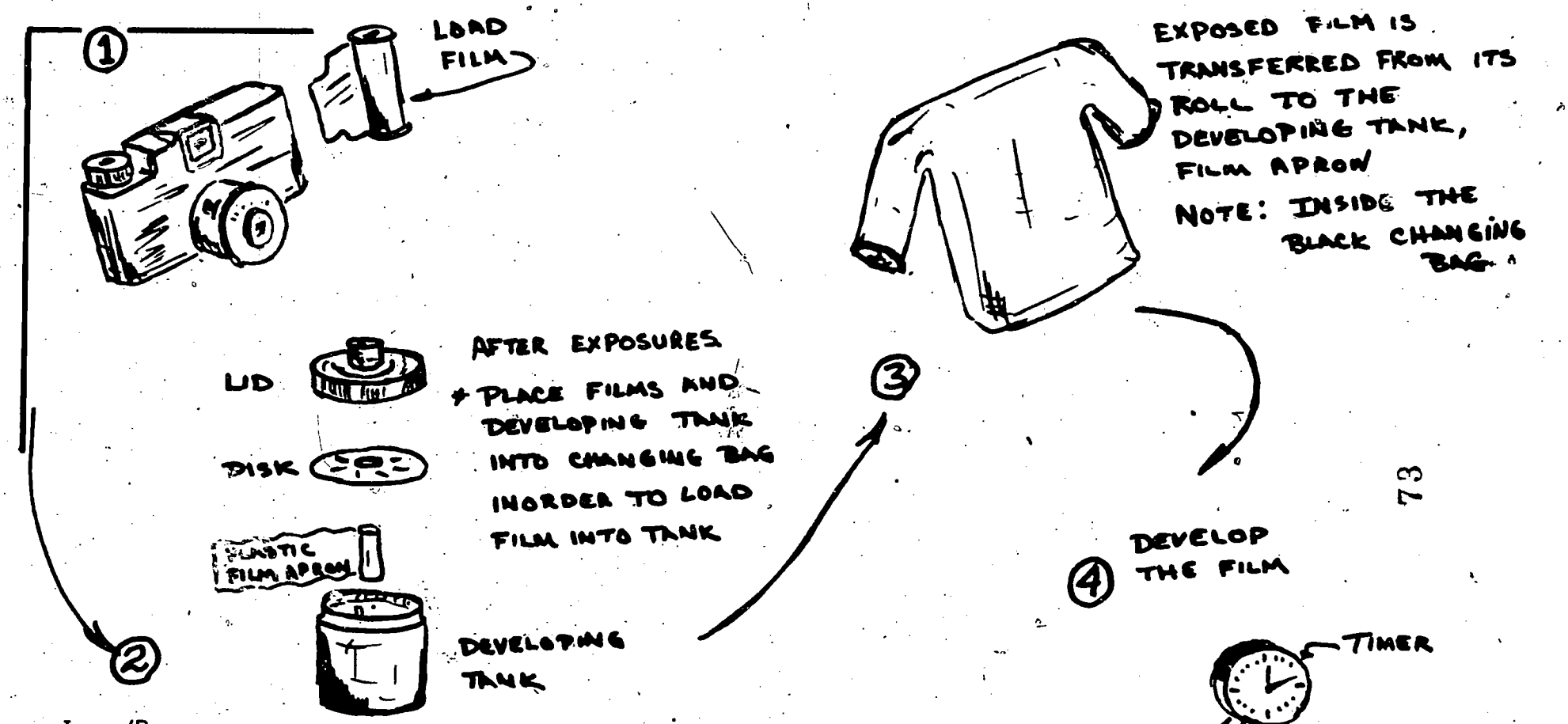
72

PROCEDURE:

1. Look at the diagram above to see the steps in the process.
2. Build wood frame mold and deckle using a staple gun to fasten wood to wood and screen to mold.
3. Make a sheet of paper then print your name or a favorite poem or quotation.
4. Read copies of these booklets:
   - Waste Paper Recycling - Issues and Answers
   - Everybody's Business - The Environmental Crisis
   - From Forest Tree to Fine Papers

FOLLOW-UP:

- Write short stories, poems, favorite quotations or descriptions of something. Then make enough paper to print copies of your writing. This could develop in many directions, including a publishing enterprise.
- Find out about recycling any product. Why is it being done? What problems do people have who recycle materials?



IDEA/PROBLEM

Here is a simple way to use photography as a tool with regular photographic materials. No darkroom or sink is needed but you will need water.

Many extensions of this simplified photography are possible such as: photo murals, pinhole coffee can or shoebox cameras, photograms, motion pictures, animated filmmaking and darkroom work such as enlarging.

Start with this easy, inexpensive idea. Then as interest grows, expand your work.

PROCEDURE:

Examine the camera-load film-take pictures

1. Pick up and examine a camera. Remove the back. Try out all the controls and observe what happens. Study the instructions and find out what each control does.

2. Load a roll of 120 black and white film into the camera. Go outside and shoot the roll of film. Possible subjects: people, animals, plants, cars, buildings, tall things, funny things.

Transfer film to developing tank

1. Remove the exposed film roll from the camera. Keep it in a tight roll until it is inside the changing bag.

2. Place the film roll and developing tank inside the changing bag then zip up the bag.

3. Hold the bag on your lap, place both hands inside the arm holes then unroll the film. Separate film from its cover paper.

4. Roll the film and the film apron together into a cylinder, then place film and apron inside the developing tank. Place metal disc on top of film-apron roll then put the top cap on the tank. Now remove the loaded tank from the changing bag.

Prepare chemicals

1. Mix a <u>stock solution</u> of kodak dectol developer - 1 gallon.

(Next page for further procedures)

MATERIALS AND EQUIPMENT

<u>Equipment and Supplies for each Photographer</u>:

- 1 120 size camera, SEE, Diana, Panax, Rover or similar inexpensive $1.50-3.00 camera
- 1 Roll (16 exposures) black and white, 120 film i.e., Kodak Verichrome pan film.
- 20 sheets 3" X 3" wet developed blueprint paper

<u>Equipment/Supplies for a group of 6-12</u>:

- 1 Kodacraft developing tank with 120 size apron
- 1 Box Kodak lantern slide glass
- 1 Photoflood No. 2 lamp and reflector
- 1 Photo or kitchen timer or wristwatch
- 1 Changing bag
- 2 Plastic bucket (1 gal. size)
- 1 pair scissors
- 1 Roll heavy string or cord
- 1 Plastic dishpan
- 1 Roll paper towels
- 1 Roll masking tape
- 1 Cleanup sponge
- 12 Plastic spring clothespins

<u>Chemicals for one or a group</u>

- 1 Qt. Kodak dektol developer
- 1 Pt. 3% Hydrogen Peroxide
- Fresh water

PROCEDURE:

2. Mix a stock solution of Kodak fixer - 1 gallon.

3. Make a working solution of developer by diluting 1 part stock solution with four parts water. Make a quart.

4. Use fixer stock solution full strength.

5. Add a few drops of 3% hydrogen peroxide into 1 qt. of water for developing blueprint paper later.

Develop the film

1. Fill the loaded developing tank with the working solution of Dektol developer. Gently agitate the full tank for 5 minutes. Pour out the developer and fill the tank with fresh water. Rinse film for 30 seconds by gently shaking the tank.

2. Fill the tank with fixer. Similarly, agitate the tank for 5 minutes. Pour out the fixer. Fill the tank with fresh water and rinse. Remove the film and hang it up to dry. These are your negatives.

Make Prints

1. Tape one edge of 2 lantern slide glasses to make a sandwich. Lay a piece of blueprint paper-blue side up-in the sandwich then lay your negative on top of the blueprint paper dull side down and close the sandwich. Lock the glasses together with a clothes-pin.

2. Expose the blue print paper to sunlight until the visible edges of the paper change to near white. The time for this exposure depends on how bright the sun is and on how dark your negative is. Darker negative-longer exposure. Cloudy day-longer exposure.

3. If it is rainy or very cloudy, blueprints can still be made by exposing the paper through the negative under the photoflood lamp or an ordinary desk lamp if you do not have a photoflood lamp and reflector.

4. Dip the exposed blueprint paper into the water you have added 3% hydrogen peroxide to. Watch the image appear.

5. Rinse your prints in fresh water, blot dry them, then press them under paper towels and a book or piece of wood.

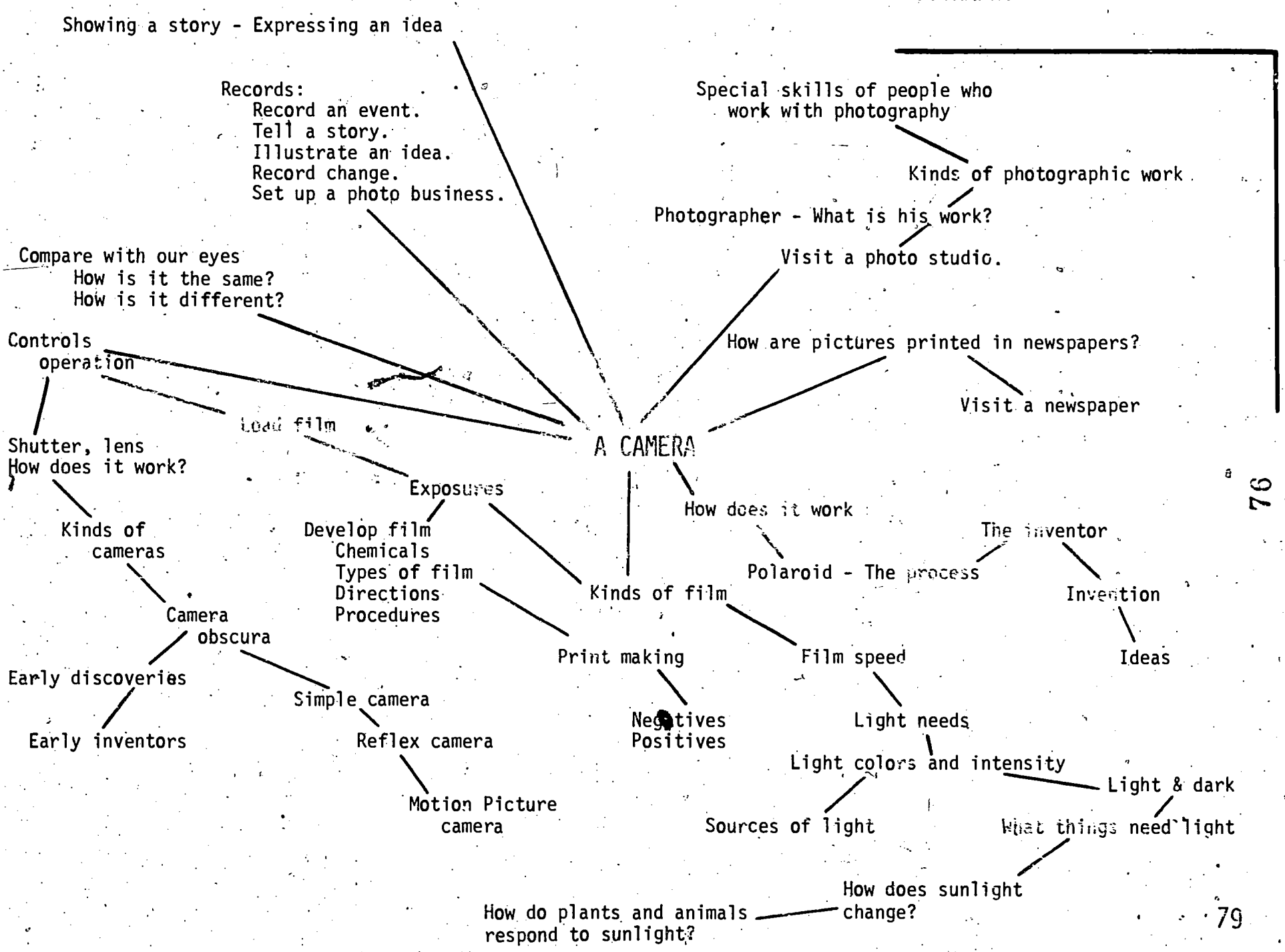
6. When dry, trim the prints and mount them.

7. Write something about each picture or make a picture story-no words-just pictures.

Blueprint paper for this photography should be fresh or new paper since it has a useable shelf life of approximately three months.

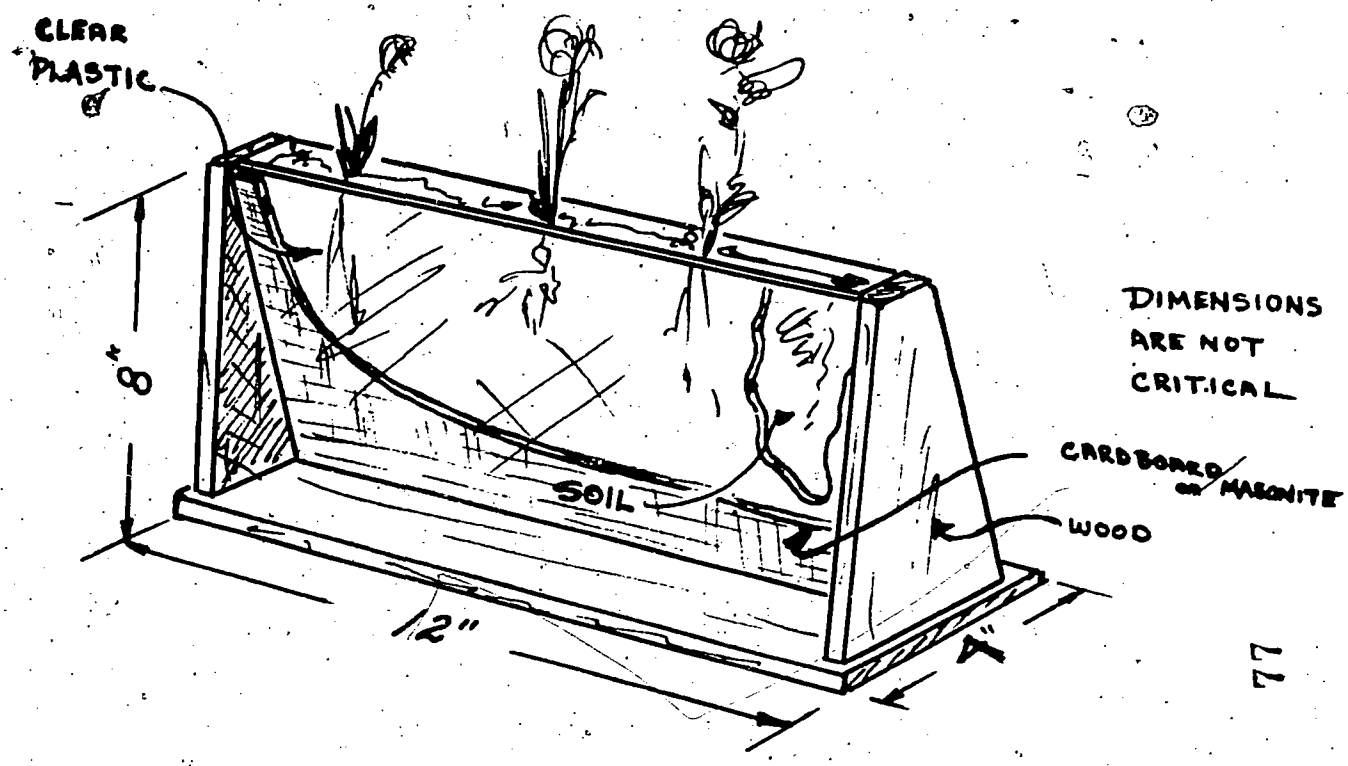
Specify: "Wet developed blueprint paper." It may be purchased from a drafting supplier or in 8" X 10" sheets from Selective Educational Equipment Company. See supplier list.

PHOTOGRAPHY



PLANT SCIENCE

"EXPERIMENT-STATION" GARDEN



77

IDEA/PROBLEM

One of the best ways to encourage children to get involved with plant life is to develop individual "experiment stations." There are no "failures."

As experimenters, they play the role of the "great horticulturists"- especially if equiped with magnifying glass, postage scale, test tubes, and vegetable dyes, small pots and a scientifically blended soil mix. They will be able to conduct their own experiments, tests and projects.

PLANT SCIENCE

"EXPERIMENT-STATION" GARDEN

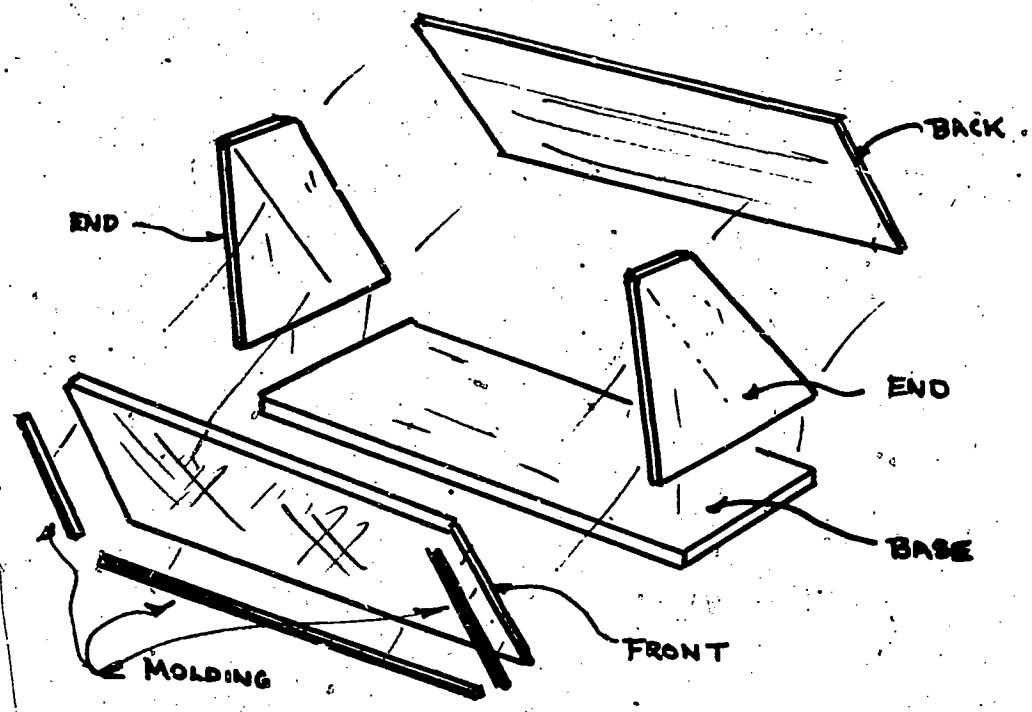
MATERIALS AND EQUIPMENT

Seeds - Radish
Bean
Beets
Lettuce

Soil - Local
Planter mix

Plant Food - liquid or solid
Wood (1) ½" X 6" X 36" pine-base and ends
(1) ¼" X 10" X 12" hardboard-back
Plastic or glass - have cut to size-front
Cover - (1) piece cardboard or masonite to fit over clear plastic side

Claw Hammer
Hand Saw
Sabre Saw
Postage Scale
Magnifying Glass
Test Tubes
Peat pots



PROCEDURE:

1. Cut one base and two end pieces (measurements determined by need).
2. Glue and nail pieces together.
3. Use glass or plastic for front pane. Cover it by taping cardboard or masonite to the outside to keep light off the roots but to allow periodic observation of root growth.
4. Seal around pane with caulking.

FOLLOW-UP:

- Compare experiment-station using different soil mixes.
- Compare growth of various vegetables or flowers.
- Compare the effects placements of fertilizers have on the roots growth.
- Compare frequencies in watering.

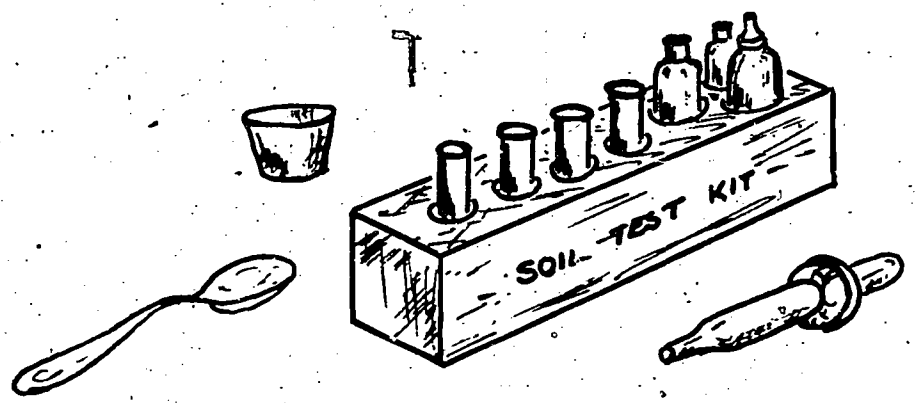
PLANT SCIENCE

SOIL TESTING

IDEA/PROBLEM

Plants, like animals, require food in order to live, grow and reproduce themselves. The amount of plant food elements in soil is relatively small. Repeated yearly removal of small portions in crops depletes the supply of nitrogen, phosphorus and potash below requirements of maximum crop growth.

Testing will help indicate the amount of plant food any given piece of soil may have.



PROCEDURE:

1. Obtain a Soil Test Kit
2. Take a small sampling of soils to be tested.
3. Develop tests for nitrogen, phosphorus and potash.

MATERIALS AND EQUIPMENT

Soil Test Kit
Plastic cups
Test tubes

FOLLOW-UP:

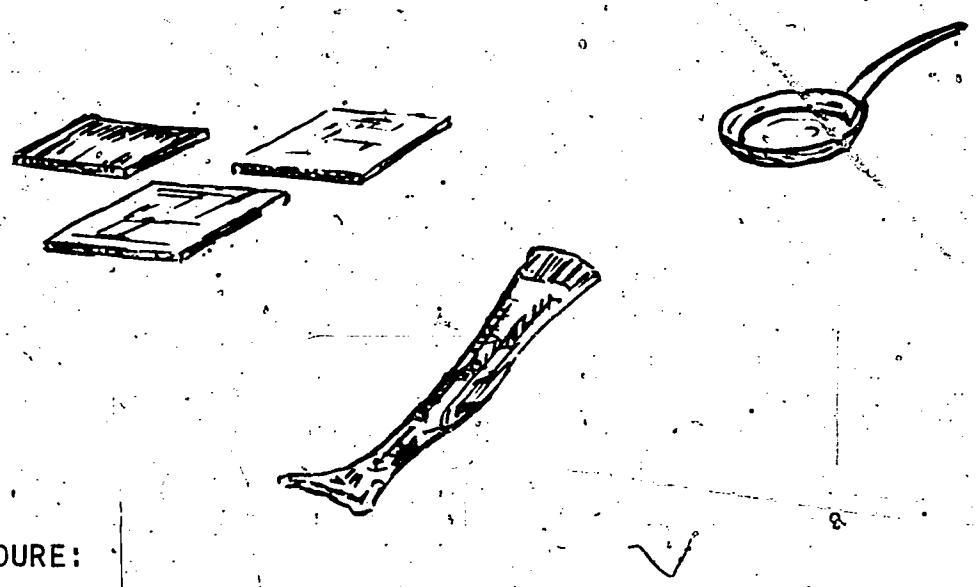
- Grow vegetables in different tested soils.
- Add controlled amounts of fertilizers.
- Try experiments with organic gardening.

PLASTICS

PROCESSES

IDEA/PROBLEM

Find out about a man made material. Compare the properties found in various groups of plastic materials.



MATERIALS AND EQUIPMENT

Plexiglas
Styrofoam
Polyethylene Film
Acrylic Tile
Vinyl Tile
Nylon
Teflon
Liquid Casting Plastic Kit
Epoxy Resin Kit
Fiberglas Kit

Saw
File
Nails
Knife
Hammer

PROCEDURE:

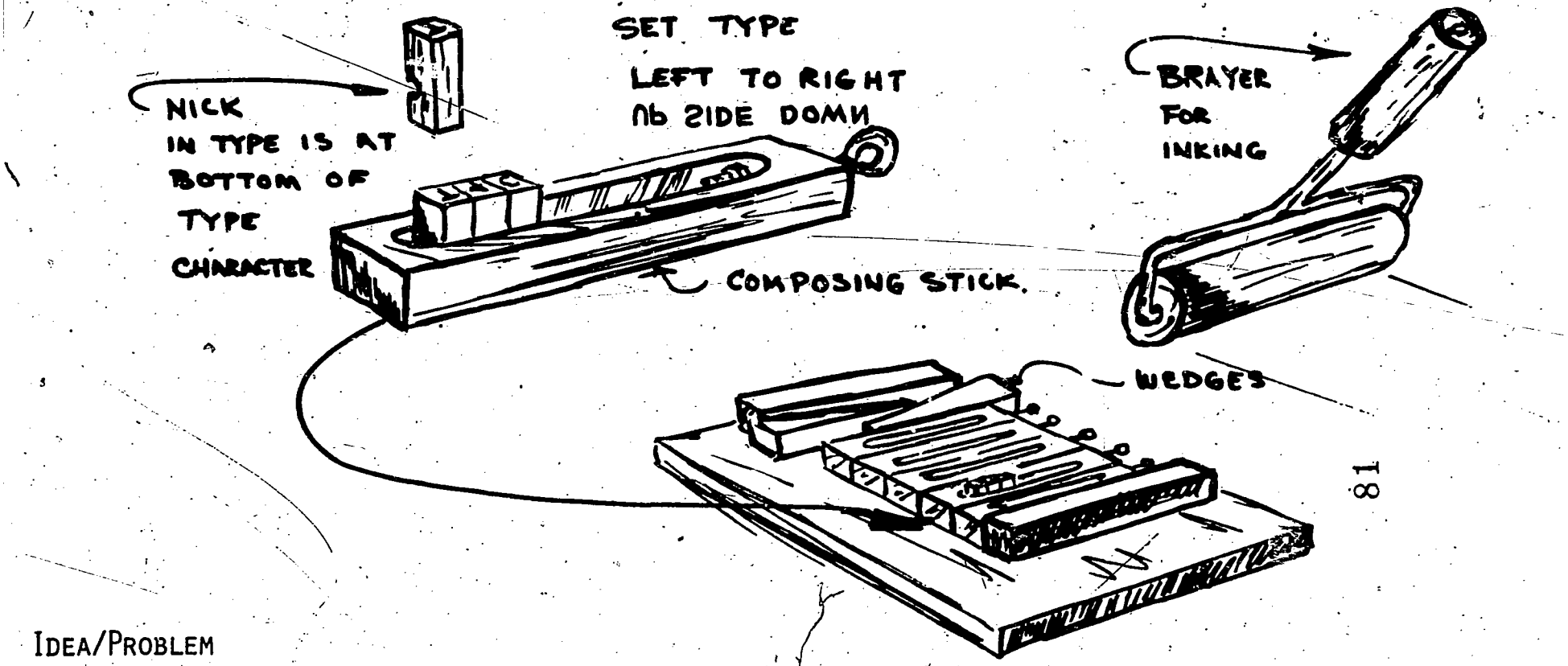
1. Separate plastic materials into groups - liquids, solids, rigid, flexible.
2. Select two plastic materials of like hardness. Select two plastic materials of the same flexible qualities.
3. Arrange a test for each group of plastics. Breakable-texture-flexible-impact-optical-clarity.
4. Display the results for each given group.

FOLLOW-UP:

Read - Plastics. Godfrey, Illinois, Cope Plastics, Inc., 1971.

PRINTING

LETTERPRESS



81

IDEA/PROBLEM

Printing from a raised surface leaves an impression like footprints in wet snow. Some ways to do it simply are with rubber stamps, typewriter, and inked hand pressed against paper, strip label tapes, and metal type.

A typewriter set up on a table and available for children encourages typing as a regular communications process. Similiarly, alphabet stamps, eraser stamps, strip label tapes and a set of printers type regularly available, extend communications possibilities. Outfits are available from Workshop for Learning Things.

- COMPOSING STICKS LOCKED UP
- READY FOR INK.
- PAPER TO PRINT ON AND PRESSURE APPLIED TO TOP OF PAPER WITH FLAT BOARD TO MAKE AN IMPRESSION

PRINTING

LETTERPRESS

MATERIALS AND EQUIPMENT

1 GA-100 (Workshop for Learning Things) Printing Press Kit
Paper to print on
Sponge, toothbrush and paper towels for cleanup
1 Vinyl floor tile for an inking surface

PROCEDURE:

For moveable type only:

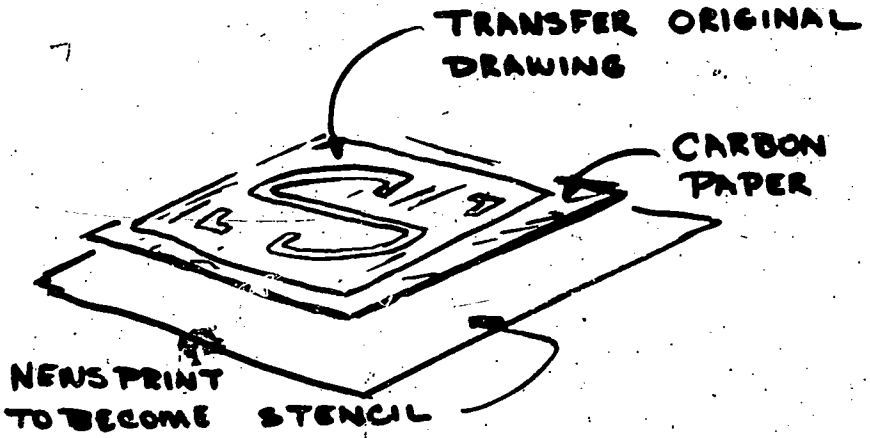
1. Pencil sketch a favorite quotation, expression or writing to be printed.
2. Set each line of type left to right in the slotted wooden composing sticks. Look at the sketches. Then, lock the type in place by tightening the thumb screw.
3. Lock filled composing sticks in the press bed frame with wedges and spacers.
4. Place a small amount of water soluble ink on a floor tile then roll the brayer over it to pick up a light even coat of ink on the roller.
5. Carefully lay a sheet of paper to be printed on top of the inked type.
6. Now lay the pressure plate over your paper and press down. Re-ink and repeat for as many sheets as needed.
7. Wipe type clean with a damp cloth and soft brush, like a tooth brush.
8. Return all type to the type case.

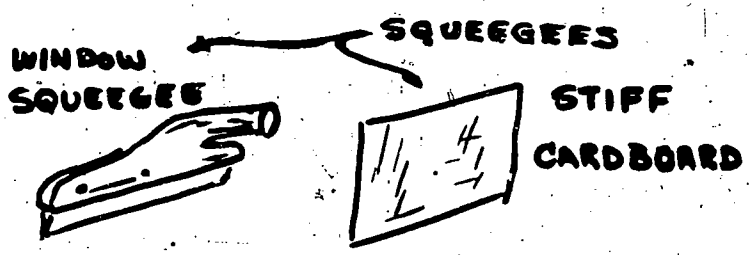
FOLLOW-UP:

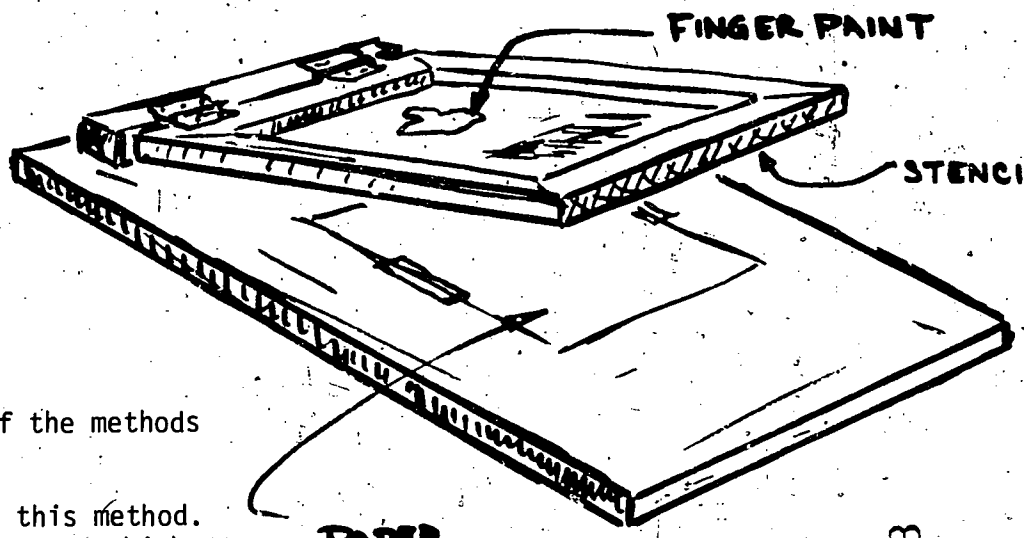
- Print your name, print a poem or favorite quotation, print a book or words to a favorite song.
- Visit the nearest print shop and see what they do and what they work with. Would you like this kind of work?

PRINTING

Screen Process







Idea/Problem

Screen printing or stencil printing is one of the methods used to duplicate an image.

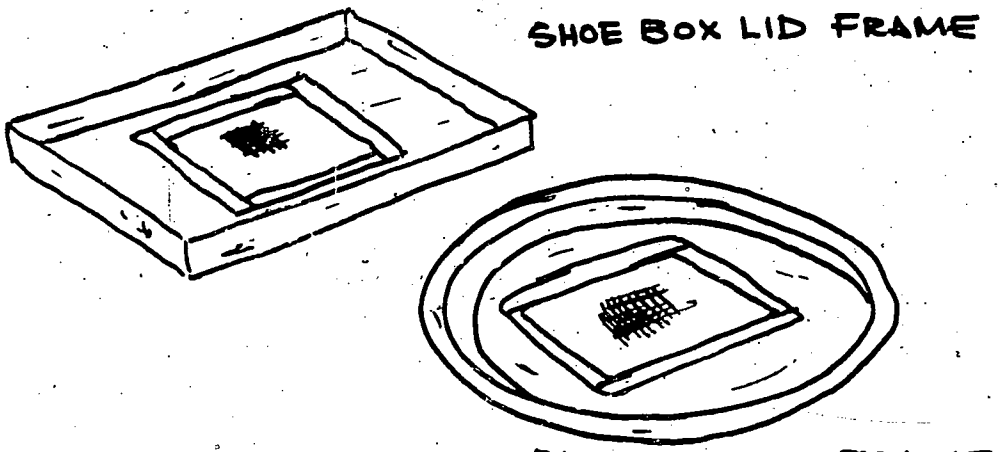
Shown here are several ideas for printing by this method. Using newspaper as your stencil, prepare a cut out area which will be the print. Then, select and prepare one of the frame ideas so the frame will be slightly larger than the stencil image. Make several copies by this method.

PRINTING

SCREEN PROCESS

MATERIALS AND EQUIPMENT

- Several sheets of paper, cardboard or surface to print on
- Newspaper
- Carbon Paper
- Pencil
- Tempera paint or finger paint or latex paint
- X-acto knife
- Scissors
- Frame material
- No. 12XX Domestic silk, dacron, organdy or nylon screen
- Squeegee-regular screen printing squeegee, or window squeegee or stiff cardstock.
- Masking tape or scotch tape
- Desk stapler
- Sponge
- Plastic bucket for water



SHOE BOX LID FRAME

PAPER PLATE FRAME

PROCEDURE:

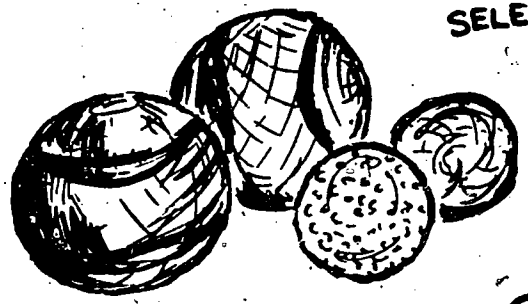
1. Either draw or trace design or image on newsprint. This will be your stencil after you cut out the image area or portion to be printed.
2. Place stencil under screen and on top of paper to print on.
3. Place a little tempera or finger paint or latex paint on top of screen. Paint should be of a thick non-running consistency.
4. Use a regular screen printing squeegee, a window squeegee or a piece of stiff card stock to draw or squeegee the paint across the screen forcing the paint through the screen and stencil opening and on to the surface to be printed.
5. Repeat the process on additional sheets of paper or surfaces to be printed.
6. Clean up by pealing off the newsprint stencil then wash all paint from the screen for the reusable frames.
7. Make new frames if you use the shoebox lid or paper plate frame ideas.

FOLLOW-UP:

- Find out how many different products are screen printed.
- What are the advantages of this printing process?

PRODUCT TESTING

BALL BOUNCE



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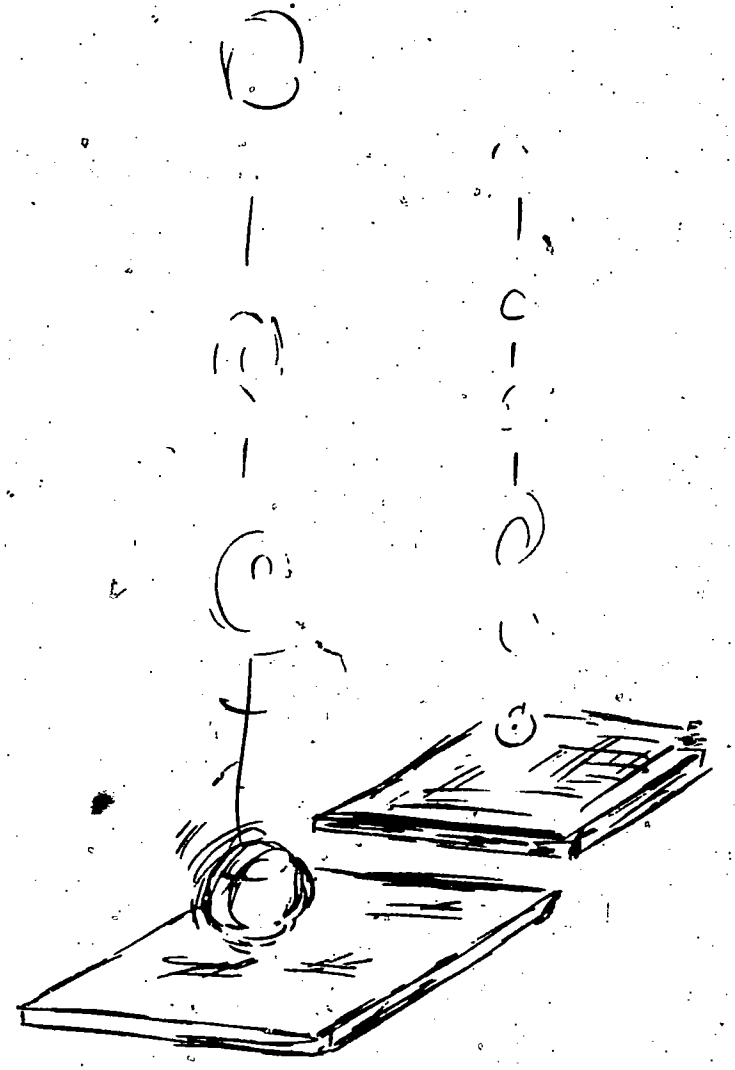
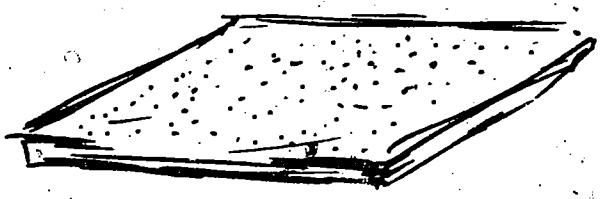


②

IDEA/PROBLEM

If you drop two comparable golf balls on a hard surface, would you expect them to bounce the same height? Select and compare the straight drop bounce of various brands of golf, tennis and ping-pong balls.

Display the results of your investigation and compare bounce with unit price.

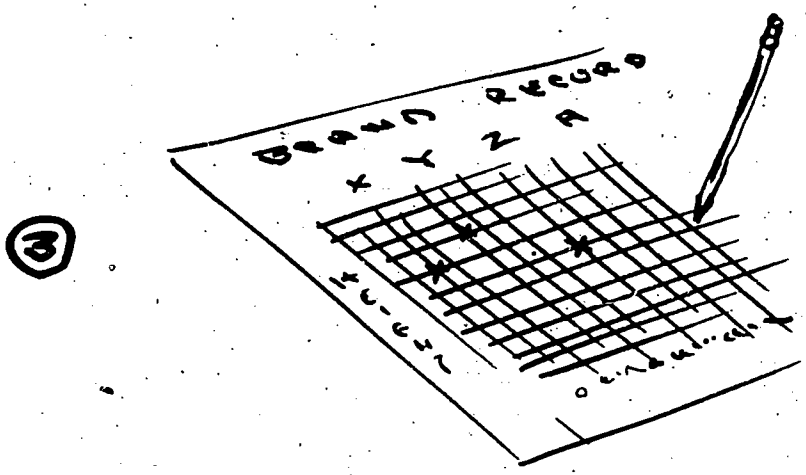


PRODUCT TESTING

BALL BOUNCE

MATERIALS AND EQUIPMENT

3 Brands each - golf, tennis and ping pong balls
Graph paper
Pencil
8 or 10 foot steel tape or yard stick



PROCEDURE:

1. Select three brands each, within a similar price range. Record the prices.
2. Arrange a test on a hard surface such as smooth concrete or a terrazo floor.
3. Drop each ball several times from 2, 4 and 8 foot heights. Record the bounce height for each drop.
4. Display the results for a given type of ball.
5. In terms of this test, which brands do you consider the best buy?
6. Was the test fair?

FOLLOW-UP:

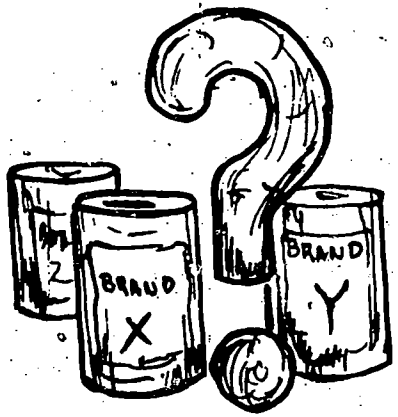
- Set up fair test procedures for another product.
- What facts have you revealed which you would recommend to anyone buying one of the products you have tested?

PRODUCT TESTING

CANNED FRUIT

IDEA/PROBLEM

Find out about a typical consumer product and unit pricing. Compare the quantity in solid fruit of two brands of canned fruit.



PROCEDURE:

1. Select two different brands of canned fruit you like. Select two brands labeled as the same type of fruit, the same net weight but with different prices.
2. Separate liquid and solid contents and measure them. Record your work: Brand A vs. Brand B.
3. Determine which brand is the better buy by content weight alone.
4. Now taste each brand. Do you find a difference in taste between brands?
5. Which brand is the best buy in your opinion?
6. Write up your findings and share them with a friend. Does he agree with you about what you have found?

MATERIALS AND EQUIPMENT

- 2 each, different brands of canned fruit - 16 oz. size
- ¼" graph paper
- Pencil
- 1 set quart size plastic refrigerator containers
- Plastic spoons
- Paper cups
- Metric balance scale
- Can opener
- Paper towels

FOLLOW-UP:

- Compare the content and label information of other products. Do labels accurately tell about content?

PRODUCT TESTING

COMPARISONS-LABELS AND PRODUCTS

IDEA/PROBLEM

Compare common products to determine their value per unit cost. Display your results in some way and comment on them. Purchase products which are comparable in advertised features.

PROCEDURE:

1. Compare the length and quality of the line two similar ball point pens will write.
2. Test the strength of comparable string, thread, rope and twine.
3. Test various brands of cellophane tape for strength, holding power, ease of marking on and water resistance.
4. Record several television product commercials then discuss and duplicate them if possible. Compare your results with the commercials.
5. Test the sun fade of paints, colored cloth, plastic products and various types of paper.
6. Test the insulation and sound absorbtion qualities of various materials.
7. Is the test situation in each case controlled and fair?
8. Illustrate and comment on your results.

MATERIALS AND EQUIPMENT

Select a range of common comparable materials and products. Don't be limited to only these suggestions. The tests will require control so only one condition is varied at one time. The test set up itself may generate questions about accuracy fairness, control and reliability. You may want to duplicate several tests under different conditions. Does cost alone determine quality?

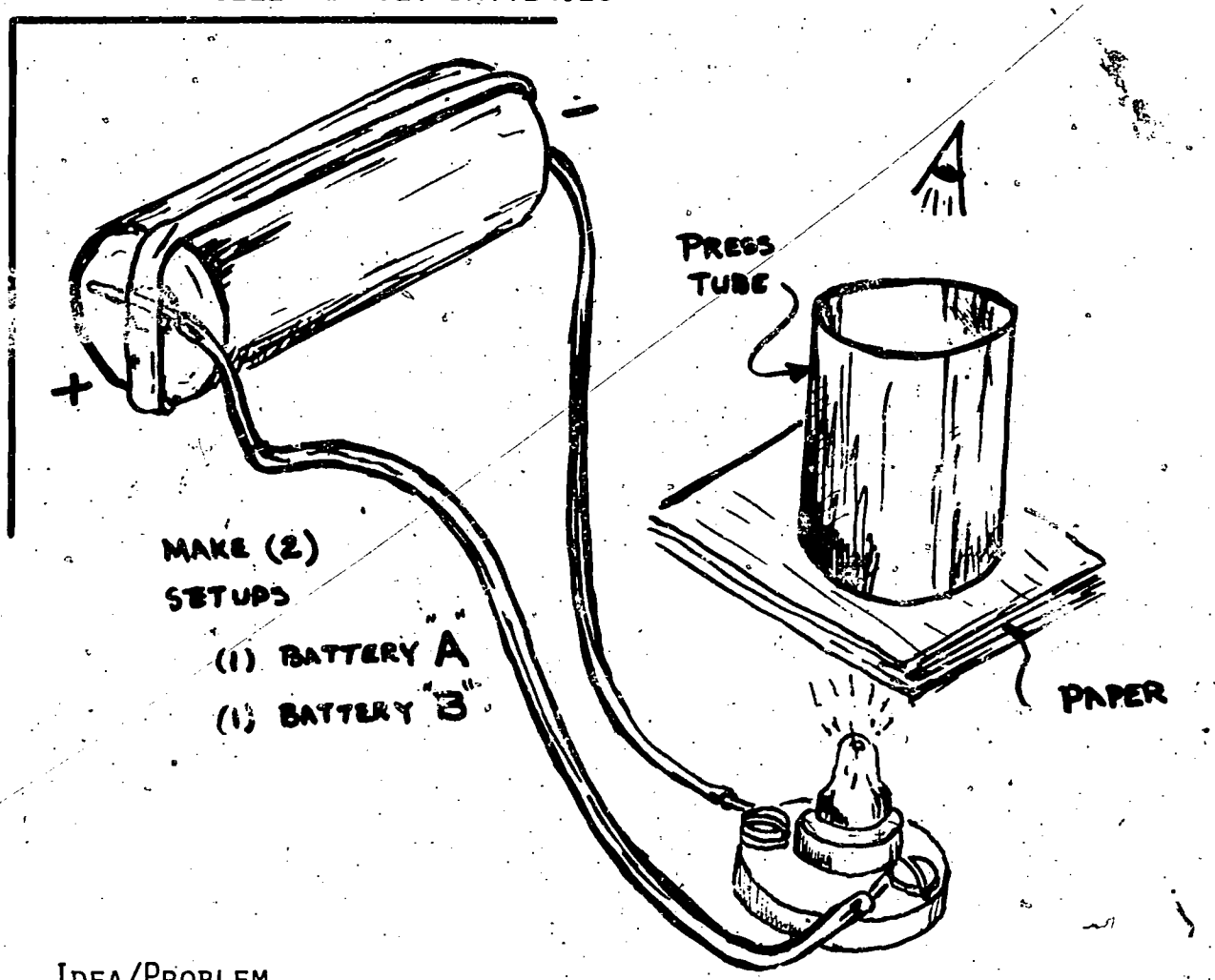
88

FOLLOW-UP:

- Find out how producers, consumer agencies and the government test products.
- Find out what the Underwriters Laboratory does.
- Comment on your findings and record them in some way.

PRODUCT TESTING

"D" CELL 1½ VOLT BATTERIES

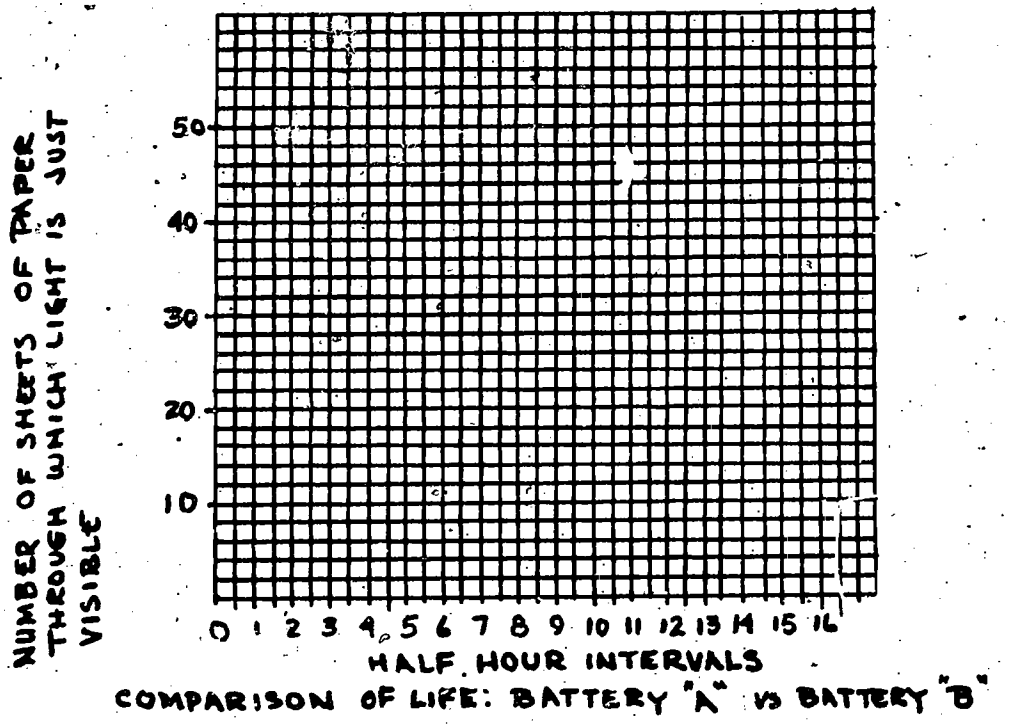


PRESS TUBE TO PAPERS AND PAPERS TO LAMP. HOLD THE TUBE CLOSE TO YOUR EYE. START WITH THE NUMBER OF SHEETS OF PAPER WHICH WILL JUST ALLOW LIGHT TO BE SEEN. PLOT THIS NUMBER FOR BOTH BATTERIES ABOVE THE ZERO ON THE TIME LINE OF THE GRAPH. CONTINUE CHECKING AT HALF-HOUR INTERVALS.

89

IDEA/PROBLEM

Find out about a typical consumer product by testing it. Compare two brands of "D" cells, 1½ volt batteries.



COMPARISON OF LIFE: BATTERY "A" VS BATTERY "B"

PROCEDURE:

1. Select two brands of 'D' cell, 1½ volt batteries. Record their unit price and date of purchase.

2. Connect each cell to the same type number 1½ volt miniature lamp. Look at the sketches.*
   *Note: Two miniature lamps of the same type and number may still be different electrically, so this test will be approximate.

3. Measure lamp brilliance at some regular time interval by observing lamp light through stacked sheets of bond paper. Record the number of sheets through which light can just be seen by pressing the paper tube to stacked sheets of paper against the top of the lamp.

4. Record the results in graph form.

5. Compare the unit cost of these batteries with their measured life. Which battery is the better buy?

PRODUCT TESTING

"D" CELL 1½ VOLT BATTERIES

MATERIALS AND EQUIPMENT

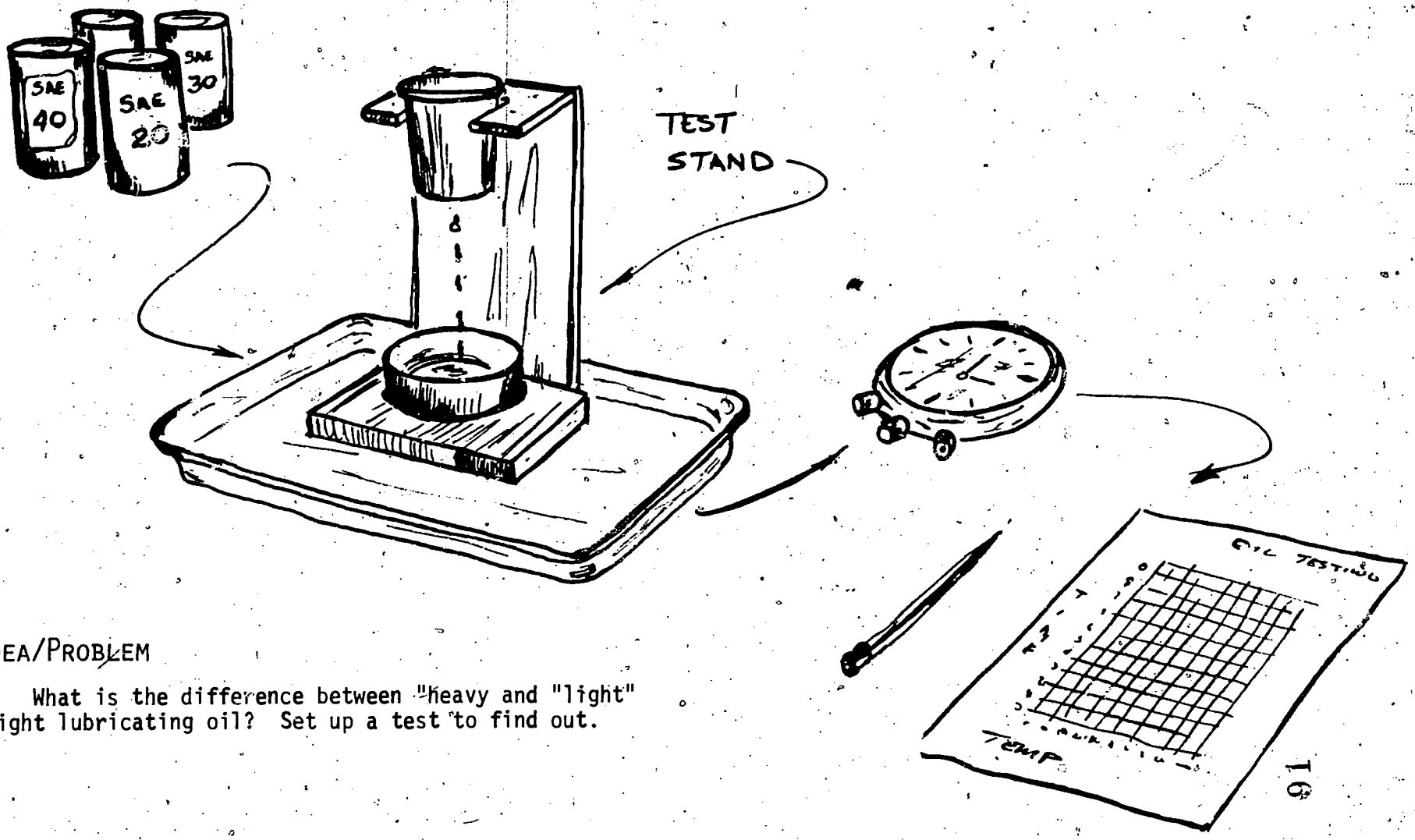
- 2 1½ volt 'D' cells
  - 1 brand A
  - 1 brand B
- 2 No. 112 miniature screw base lamps
- 2 Miniature screw base lamp sockets
- 2 ft. No. 20 solid insulated copper hookup wire
- 1 1½" diameter paper tissue or paper towel tube
- 20-40 3" X 3" pieces bond paper
- 2 Rubber bands
- 4 Fahnestock clips
- Clock or wristwatch
- Wire cutter-stripper

FOLLOW-UP:

- Do different brands and priced 'D' cells provide comparable services?
- Does the age of a battery affect its usefulness?
- What further information would you recommend be provided with batteries at the time of purchase?
- What is the shape of the curve in the graph of the longest lasting battery?

PRODUCT TESTING

LUBRICATING OILS



IDEA/PROBLEM

What is the difference between "heavy and "light" weight lubricating oil? Set up a test to find out.

PRODUCT TESTING

LUBRICATING OILS

MATERIALS AND EQUIPMENT

4 Different engine oil S.A.E. weights
8 Paper cups
1 3P or 4P nail or a #16 brad
Graph paper
Pencil
1 Aluminum oven tray - use as work area
1 Stop watch
1 Can opener
Masking tape
Hammer

92

PROCEDURE:

1. Secure four different brands and weights (10-20-30-40) of lubricating oil. One quart is a standard package unit.
2. Punch a small nail hole from the inside center of the bottom of four small paper cups. Tape the hole closed with masking tape from the outside.
3. Fill each container with the same amount of one of the oils. Mark each cup with one number: 10-20-30-40.
4. Hold each oil container and, one at a time, remove the tape over the bottom hole. Use the stop watch to time the oil flow from each container. Record the results in graph form.

FOLLOW-UP:

- What is the effect of oil number on oil flow?
- What is the effect of temperature on oil flow?
- Check an owners manual for an automobile. What type of oil is recommended in summer? In winter?

PROPERTIES OF MATERIALS

SAND AND WATER

Some basic properties of materials and concepts to explore with sand and water:

- Equivalence
- Flow
- Quantity-more than-less than-equal
- Number, Ordinal-Cardinal
- Proportion
- Weight, less than-more than-equal
- Volume
- Area
- Capacity
- Time
- Evaporate
- Balance
- Mould
- Level
- Combining-separating
- Sequence
- Absorb
- Suction
- Syphon
- Pressure
- Buoyancy, float-sink
- Reflection
- Refraction
- Erosion
- Opacity
- Transparent
- Filter
- Texture
- Freezing-thawing
- Soluble
- Thin-thick
- Sets

93

IDEA/PROBLEM

Sand and water have great appeal to children. These common materials provide a way for children to deal with many material properties and concepts.

A way to begin is to choose a partner and together, find out how many of the above properties and concepts you can demonstrate or show with sand or water or a combination of them.

Use any of the hardware items listed to help you.

Think of other properties and concepts which can be shown with sand or water. Demonstrate these in some way.

Record your work with sketches of your ideas and comments about what you have done.

"For the only motivation of learning that is really important is the motivation intrinsic to learning itself. And the only satisfaction, the only reinforcement that counts importantly is that which accrues from discovery, from finding structure and order in our individual and unique experience."

David Hawkins
On Living In Trees

PROCEDURE:

SAND - Lift the sand in one hand and let it flow through your fingers. Sift it, wet it and mould it. Form a shape in wet sand. Weigh it. Pour it through a funnel. Think about the properties of sand and the concepts you can demonstrate with it.

WATER - Set up a portable holding place for water on the floor or on a sturdy table or bench. During the spring and fall, this work can occur outdoors. Record each illustrative arrangement that you make with sketches and comments. Which of your senses or combination of senses do you use as you illustrate each property or concept?

PROPERTIES OF MATERIALS

SAND AND WATER

MATERIALS AND EQUIPMENT

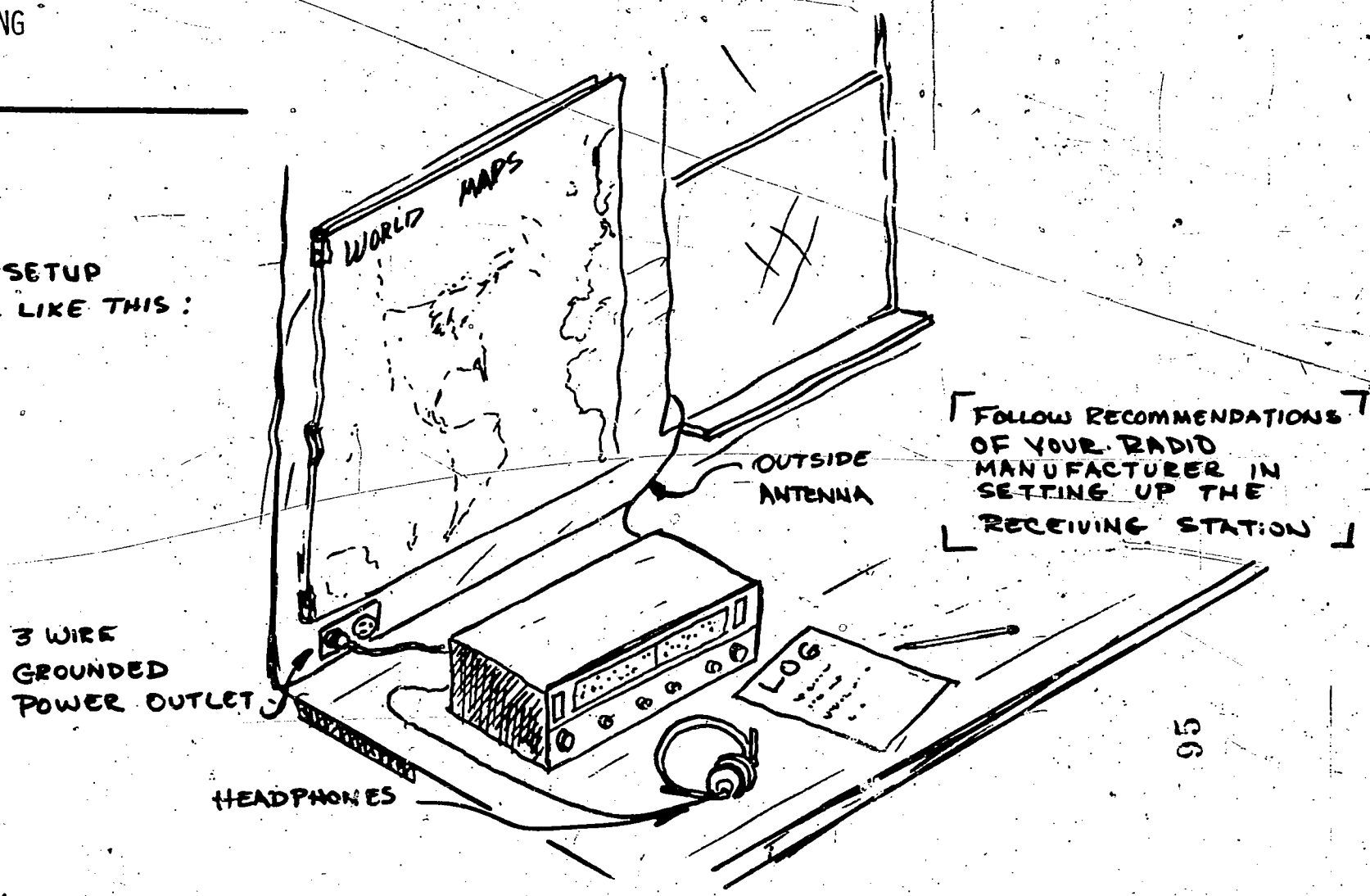
Sand (local builder's supply-play sand and masonry sand)
Water (clear drinking water)
Capacity measures - English: pt. qt. gal.
Metric: liter, ml.
Childcraft Water Play Kit
Large transparent plastic syringes
Aluminum liquid measures
Plastic ½ pt. to 1 gal. water jugs
Aluminum can and sifter set
Sand box - a rigid wall box
Tire pump
Holding place for water - any large shallow container
Pan balance scale
Plastic tubing
Containers: Tin cans, wax paper, milk cartons, cake pans, food boxes, clear plastic
Long clear plastic tubes with rubber stoppers for the ends
Food coloring
Ballons
Hot water bottle

FOLLOW-UP:

- Compare each of the properties of materials you have illustrated or shown with as many other materials as possible.
- Illustrate each concept in many ways.
- Arrange materials in such a way that you can return again and again to work at each idea you generate.

RADIO MAPPING

A TYPICAL SETUP MIGHT LOOK LIKE THIS:



IDEA/PROBLEM

Use a shortwave radio with earphones to find out how many station locations you can identify from broadcasts. Then locate the stations on a map or maps. Keep a log of stations you have identified.

KETTERING'S DEFINITION OF RESEARCH

"Research is a high-hat word that scares a lot of people. It needn't. It is rather simple. Essentially, research is nothing but a state of mind--a friendly, welcoming attitude toward change. . .going out to look for change instead of waiting for it to come. Research, for practical men, is an effort to do things better and not to be caught asleep at the switch. The research state of mind can apply to anything: personal affairs or any kind of business, big or little. It is the problem-solving mind as contrasted with the let-well-enough-alone mind. It is the composer mind instead of the fiddler mind. It is the 'tomorrow' mind instead of the 'yesterday' mind."

RADIO MAPPING

MATERIALS AND EQUIPMENT

1 Four band shortwave radio receiver such as Heathkit SW-717
1 Set headphones-Heathkit GD-396
1 Long wire antenna such as Heathkit GRA-72
1 Current editions of:
- World Radio-TV Handbook
- The American Radio Relay League Booklets on Amateur Radio

1 World Map or Maps of separate countries
Pencil or Pen
Log sheets with a place for recording: date, time, station or call letters and name of person receiving information and something about the content of the broadcast
Box of map pins

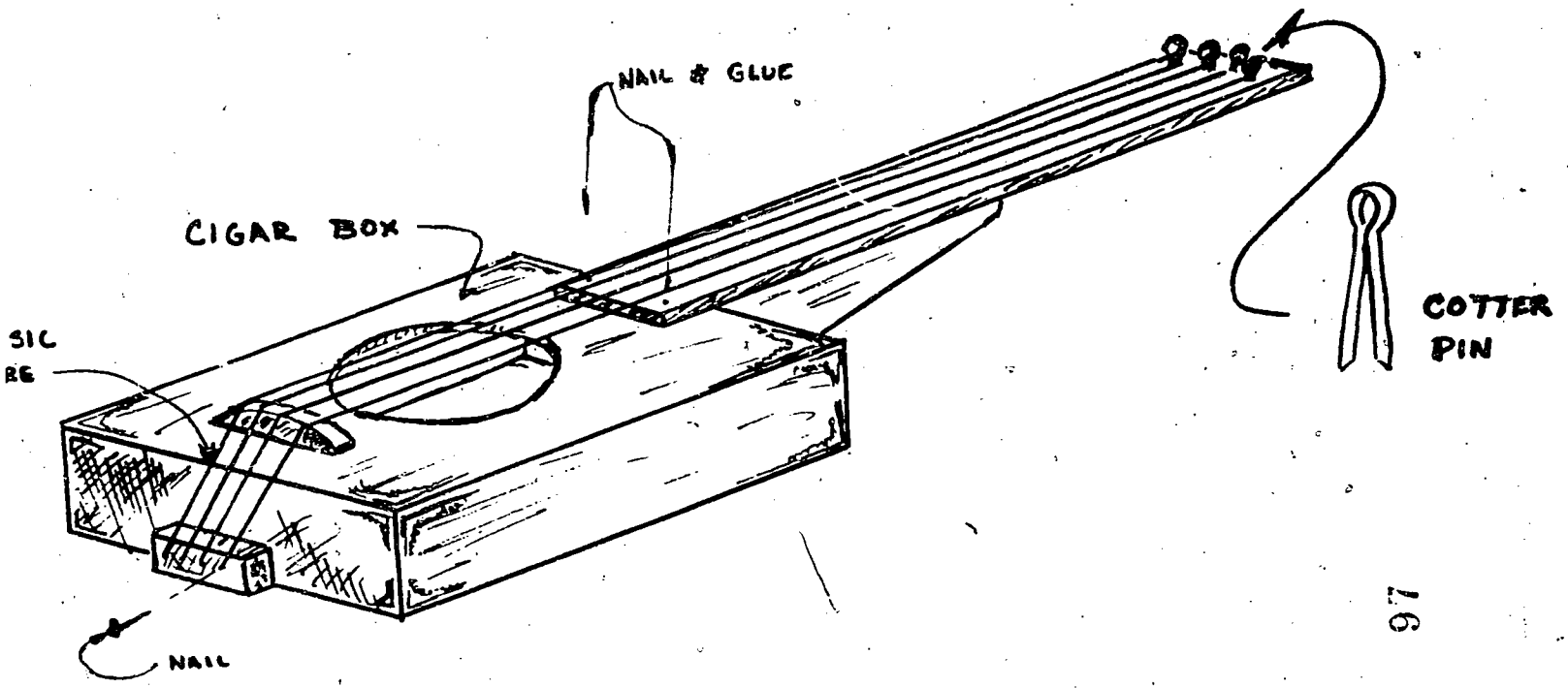
PROCEDURE:

1. Set up a shortwave radio receiver with an outside antenna if possible. A location near an outside window is good.
2. Be sure radio is grounded either through a standard three wire power plug or by a ground wire attached to the radio. Follow the manufacturers recommendations for safe operation.
3. Take turns listening and logging received and identified stations, then locating the station on a world map.
4. The radio receiver should be allowed to operate 5-10 minutes before use on those days it will be used.

FOLLOW-UP:

- How many local standard broadcast stations 550 KHz to 1650 KHz can you identify?
- What differences do you find in broadcasts?
- How may foreign stations can you pick up? How did you identify them?
- What do people talk about on amateur radio?
- What is needed to become an amateur radio operator?

GAR BOX VIOLIN



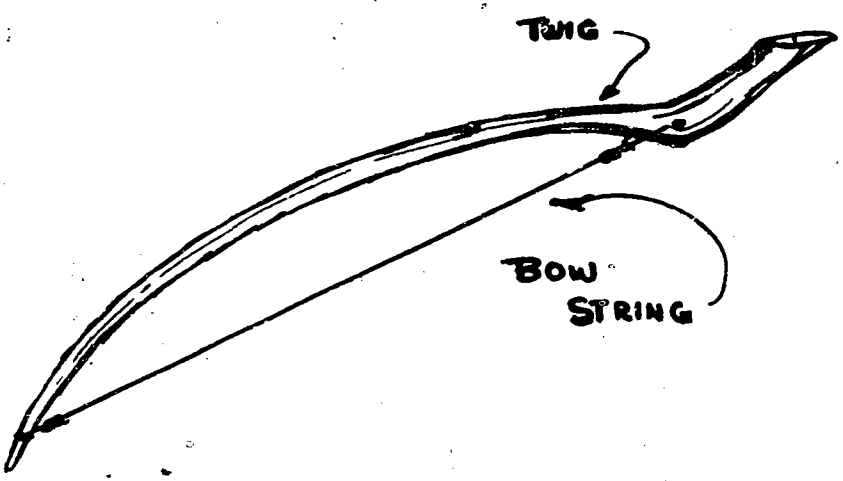
ROBLEM

discovery of sound made by vibration in this case by
ing rubber bands, wires or nylon fishing strings over
ill enable students to determine pitch of a note by
ng tension. By plucking strings, a better understanding
ed pitch and tone can also be experienced.

CIGAR BOX VIOLIN

MATERIALS AND EQUIPMENT

Cigar Box or any similar box
Music string
Wood ½" X 3" X 12"
String for bow
Cotter pins



98

PROCEDURE:

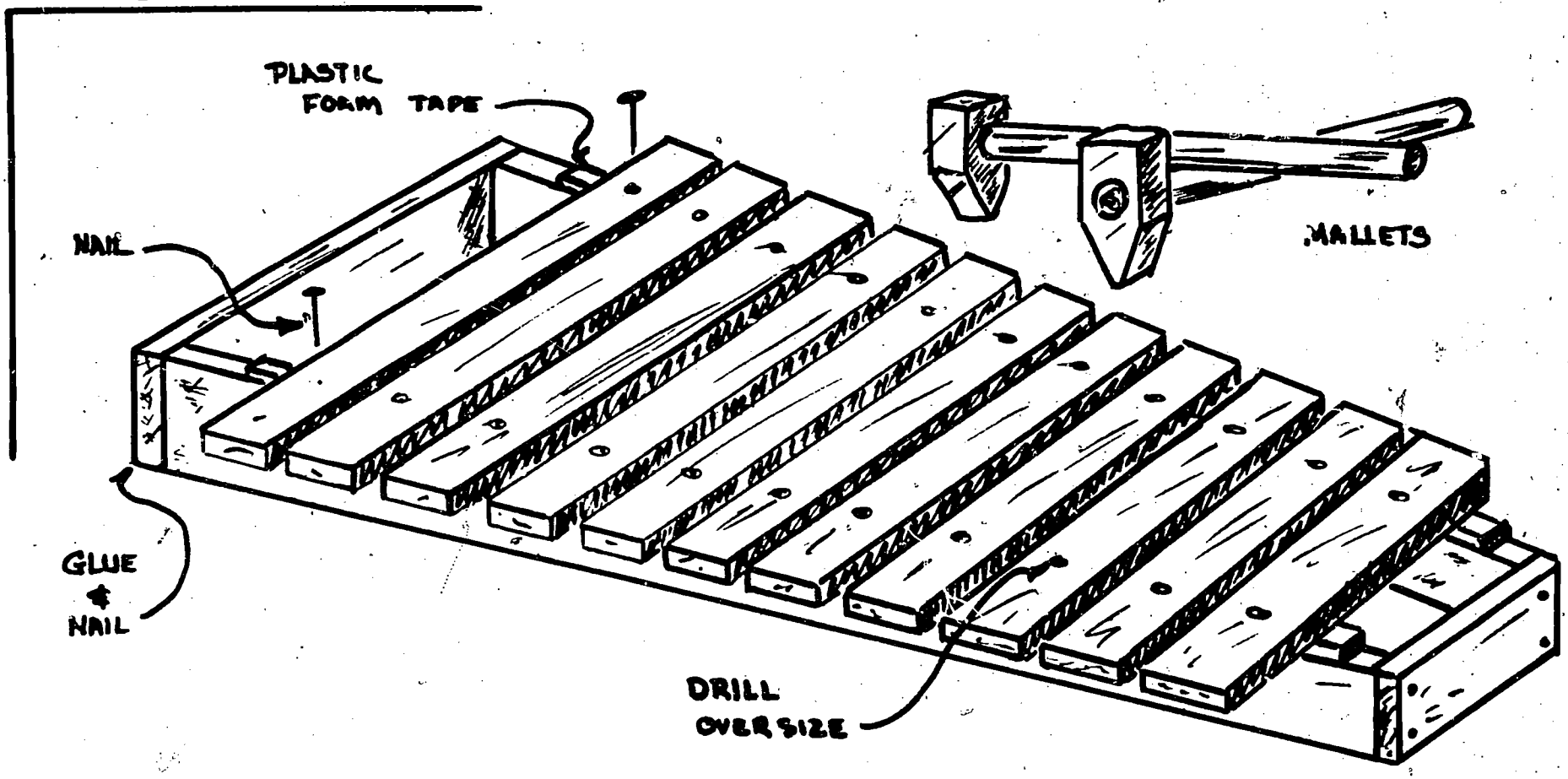
1. Gather materials and parts.
2. Try to assemble these parts yourself so as to make the cigar box violin as shown in sketch.
3. Problem solve necessary changes.

FOLLOW-UP:

- What other types of material could be used?
- Listen to music centered around this instrument.
- Try making design changes.

SOUND

DEVELOP A XYLOPHONE



IDEA/PROBLEM

Student will be able to discover that materials can make sounds in a controlled manner.

The concept of an octave (8) can be introduced in a meaningful way with the aid of the Xylophone.

66

DEVELOP A XYLOPHONE

MATERIALS AND EQUIPMENT

Wooden Strips 1¼" X 1¼" X 12"
OR - Keys
Dowels 3/4" Diameter X 36"
Strips 3/4" X 1 1/2" X 18" - Base
Plastic foam tape 3/8" wide and 1/4" thick
Glue - white

Panel Saw
Mitre Box
Claw Hammer
Drill Bit
Hand Drill
Ruler

PROCEDURE:

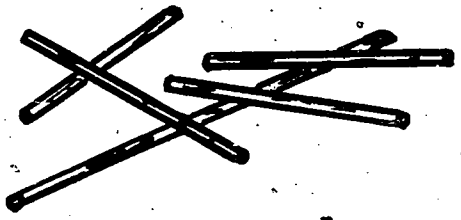
1. Cut one bar of wood 1¼" X 1¼" X 7"
2. Hold first bar lightly between two fingers and tap with another piece of wood (Key C).
3. Cut another piece about 4½" long. Check sound.
4. Shorter the sounding bar, higher the note.
5. Trial and error will produce desired tone.
6. Cut a total of eleven sounding bars, five longer and five shorter than the first.
7. Cut two narrow pieces of wood 18" long (base).
8. Cut rubber strips to mount onto base wood.
9. Place sounding bars along the rubber strip, space about ¼". Check tone.
10. Drill holes in bars, holes slightly larger than nails.

FOLLOW-UP:

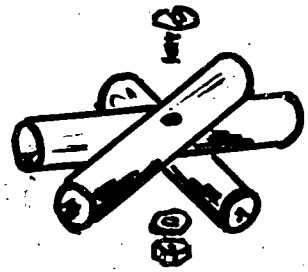
- What determines the tones?
- How can different materials effect sound qualities?
- Make further investigation into sounds and devices.

SHAPES

TRY BUILDING
BASIC GEOMETRIC FORMS

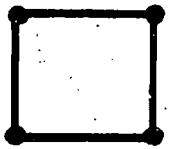


$\frac{1}{8}$" DOWELS

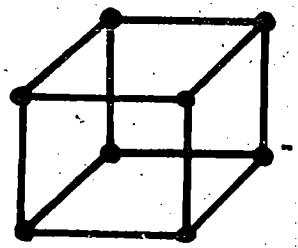


PLASTIC TUBING
OR
RUBBER HOSE

HUBS



SQUARE

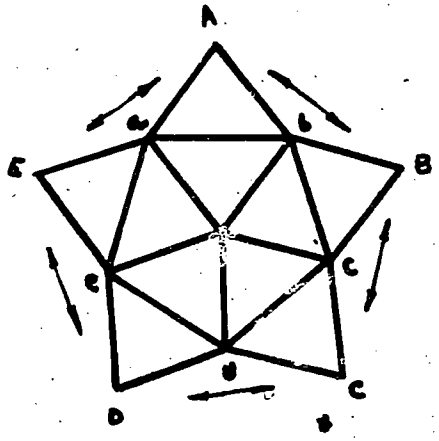


CUBE

101

IDEA/PROBLEM

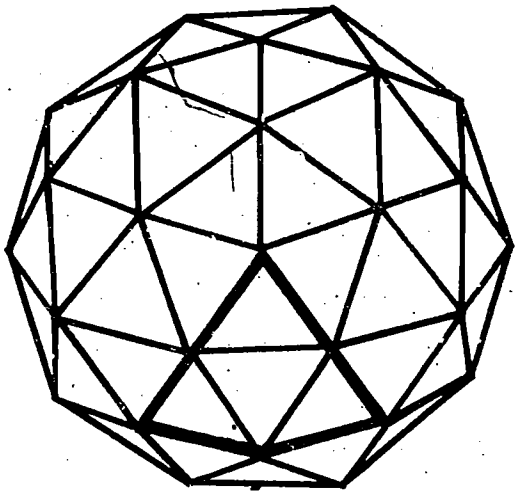
It may surprise you about different shapes when we are all conditioned to thinking in terms of squares and rectangular boxes that some are stronger than square ones and relate in interesting ways when joined together.



TRY BUILDING AN ICOSAHEDRON DOME

← PATTERN LAYOUT

DEVELOP A SPHERE



MATERIALS AND EQUIPMENT

Plastic Hose
Bolts 3/16" X 1"
Dowels 1/8"

Saw
Snips
Screw Driver
Hand Drill
1/16" Drill Bit
Ruler

PROCEDURE:

Develop a Model

1. 1/8" inside diameter plastic hose - cut to 3/4" lengths.
2. Drill in center and bolt three sections of tube together.
3. Get 1/8" diameter dowels cut to 6" lengths.
4. Experiment with the parts and notice the difference between -square -triangle -cube -tetrahedron

FOLLOW-UP:

- Which of the solids is more rigid?
- Which one will hold its shape?
- Try basic solids like octanedron
  icosahedron
  tetrahedron
- Try to construct a dome.

TOOL MAKING I

Invent and build a tool:

- That will help you pick up dirt from the floor
- That will let you pick up a paper clip, safety pin or nail from a place you cannot reach
- That lets you see over a wall or around a corner
- That helps you accurately compare the weight of small objects
- That helps you see in the dark
- For sorting a box of mixed dry bean seeds and dry rice into a pile of bean seeds and a separate pile of rice
- For sorting a box of mixed sand and wood sawdust
- That will help you measure and compare different paper strength

103

IDEA/PROBLEM

Invent and build a tool that will let you do one of the suggestions above.

(OR)

Invent and build a tool that will help you solve a problem you have posed.

- That helps you measure linear distance or weight
- That helps tell someone else what you are thinking
- That lets you communicate with someone else over a long distance
- For making music
- For testing the strength of your hands, arms, or legs
- That measures time
- For measuring and recording the position of the setting sun over a month time span from one location

ROCEDURE:

1. Consider how available materials at hand might be used to solve the problem.
2. Select and gather materials as you think about the problem.
3. When possible, place yourself in the problem situation with the materials as you think about and work to invent a tool.
4. Begin to combine, cut, shape, arrange, try or fit materials until you have a trial answer to the problem.
5. Continue your material trials until you have a tool that satisfies the problem and you.

TOOL MAKING I

MATERIALS AND EQUIPMENT

Determine both the desired problem and available common materials. Think about the problem in terms of available materials. Do the materials suggest ideas to you? Does the problem suggest its own answer?

Arrange materials in different ways as you think about the problem and arrive at new combinations and ideas leading to solutions.

FOLLOW-UP:

- Compare the tool you have created with other similar tools.
- What are the advantages or disadvantages of tools designed to do similar tasks?
- How do tools alter the nature of work?

TOOL MAKING II

Common Tool Functions include:

Gauge	Turn	Connect	Mix
Mark	Drill	Fasten	Mould
Hold	Bore	Convert	Move
Cut	Plane	Conduct	Pound
Form	Grind	Contain	Radiate
Shear	Twist	Copy	Shelter
Scrap	Guide	Encode	Support
Sort	Compare	Grasp	

105

IDEA/PROBLEM

Make a useful tool from the given materials. Then use it to perform a task.

"Man is a tool using animal. Nowhere do you find him without tools; without tools he is nothing, with tools he is all."

Thomas Carlyle
Sartor Resartus I

TOOL MAKING II

MATERIALS AND EQUIPMENT

- ¼ lb. Modeling clay
- 4 paper cups
- 12 Straight pins
- 2 1½ Volt "D" cells
- 2 No. 41 or 48 miniature lamps
- Piece soft wood scrapes
- Box assorted nails, screws
- Tube glue
- Roll string
- 12 Paper clips
- 6 ¼" dowel rods
- 2 Flat ceramic magnets
- 2 1" X 2" mirrors
- Plus any available hand tools

106

PROCEDURE:

1. Think about tools you have used and what they did. Think about how tools extend and amplify your physical capacities.
2. Examine the materials and think about how they might be arranged to perform a useful tool function.
3. Experiment with the materials to develop your tool idea.
4. With only the listed materials, make a useful tool.
5. Try the tool. Does it work?

FOLLOW-UP:

- How did the materials provided expand or limit your ideas?
- Describe the tool you have made and show someone else how it works and what it does.
- What new ability do you have with this new tool?
- After several days, come back to this problem and try to improve the tool you made in some way.

WORK AND PLAY

Some Thoughts

"It is not difficult to imagine a school of the future as a 'laboratory school'--a school making massive use of educational stimulation games, laboratory activities and creative projects--a school in which almost everything to be learned is manipulated, physically or mentally. Students will have the chance to investigate their subject matter, to feel comfortable with it, to familiarize themselves with it, and to do so in communication with other students, thereby giving to all students the benefit of additional ideas and insights. The students will be in an almost totally active learning environment, exploring and discovering for themselves."

"Play is the central activity in all nursery schools. This sometimes leads to accusations that children are wasting their time in school: they should be 'working'. But this distinction between work and play is false, possibly throughout life, certainly in the primary school. Its essence lies in past notions of what is done in school hours (work) and what is done out of school (play). We know now that play - in the sense of 'messing about' either with material objects or with other children, and creating fantasies - is vital to children's learning and therefore vital in school. Adults who criticize teachers for allowing children to play are unaware that play is the principle means of learning in early childhood."

Children and Their Primary Schools. A Report of the Central Advisory Council for Education (England), Vol. 1: The Report. London: HMSO, 1967.

"Where does education begin? Surely it begins in play and continues in play all our lives. Yet no sooner does education become formalized than it becomes solemnized."

WORK AND PLAY

Some Thoughts

"In the classroom itself, many children seem to become duller the longer they stay in school. The more work they are given to do the less they actually do. Yet the vocabulary of work escalates. There is 'home work,' 'seat work,' 'busy work,' 'work books,' 'work sheets,' 'extra work,' 'written work,' 'work contracts,' not to mention 'stop-playing-and-do-your-work' work. And the reward of all this work is play: "When you have finished your work you can go out and play."

An ethic that would make play as central to life as work would greatly contribute to the cure of our social ills. Play has more to offer to a society where the problems of what to do with leisure time are already greater than the problems of maintaining full employment."

George H. Frien, "Curriculum: A Plea For Play," Insights, Grand Forks: New School, Univ. of North Dakota, IV:3, November, 1971.

Follow-up:

- How central is "play" and "work" in your daily living?
- Is there a sharp distinction in what is work and what is play?
- What learning develops from play?
- What is "leisure" or "free-time"?

FREEBEES

ALMOST AT NO COST

MATERIALS:

Wood and Wood Materials

* Ask contractor for form lumber
* Lumber yards have scrap bins
* The beach is a great source for used wood and other things
* Building being torn down provides wood - fences - bricks
* Docks and ship yards: pallets, shipping crates, shoring lumber and sometimes rope
* Telephone or electric companys: cable spool, demonstration equipment
* Most every business and factory has packing materials - wooden crates, styrofoam, plastic
* Small wooden boxes: grocery stores, liquor store, fruit and vegetable stands
* Small wood scraps: cabinent makers, pattern makers

Paper and Paper Products

* There is an infinite supply of used cardboard boxes: grocery and appliance stores, etc.
* Fiber barrels, mailing tubes, rug tubes: shopping centers, local stores

Materials and Fabrics

* Used rugs, rug samples, rug scraps can be found at rug stores, rug installers
* Old sheets - motels

Plastic and Styrofoam

* Plastic scraps of various sizes, shapes from plastic dealers, sign makers
* Foam scraps mattress makers, furniture
* Styrofoam scraps: food trays, electronic dealers, motorcycle dealers, construction contractors, supermarkets

Metal

* Check local metal fabricators for scraps
* Tin cans recycle from restaurant, local homes

Miscellaneous

* Tires, innertubes, rope, hollow core doors
* Leather scraps from tanneries
* Obsolete electronic parts from wholesale companies
* Plants from nurseries, agricultural schools, forestry service, park departments

Surplus Goodies

* The government: the miliary bases and general service administration

* Check your district - find out how to requisition materials

* The "Yellow Pages" of your telephone book under Trash

Booklets and Directories

* Yellow Pages of Learning Resources. Cambridge, Massachusetts. The MIT Press, Massachusetts Institute of Technology, 1973.

* Kay Kellogg Creative Cookery. Battle Creek, Michigan, Department of Home Economics Services, Kellogg Company, 1973.

* Beautiful Junk. Washington, D. C., Project Head Start, Office of Child Development, U. S. Department of Health, Education and Welfare, 1973.

* New Jersey 4-H Club Science Guide - From Egg to Chick. Incubators and Their Operation. New Brunswick, New Jersey, Cooperative Extension Service, College of Agriculture and Evnironmental Science, Rutgers - The State University, 1973.

* EDC News. Newton, Massachusetts, EDC Publication Office, 55 Chapel Street, Newton, Massachusetts, 1973.

* A Bibliography of Open Education. Newton, Massachusetts. Education Development Center, Inc. 55 Chapel Street, 1971.

FREEBEES

Almost at No Cost

* Farallones Scrapbook. Pt. Reyes Station, California, Farallones Designs, Star Route, 1972.

* Consumer Product Information. Pueblo, Colorado, Public Documents Distribution Center, 1973.

* The Integrated Day in An American School. Boston, Massachusetts, National Association of Independent Schools, Four Liberty Square, 1970.

* Mountain View Center for Environmental Education. Boulder, Colorado, University of Colorado, 1511 University Avenue, 1972.

* A Starter Catalog of Free Materials. Fargo, North Dakota, The Resource Center for Man-Made Environment Education, Department of Architecture, North Dakota State University, 1973.

* Cloudburst-A Handbook of Rural Skills and Technology. Berkley, California, Book People, 2940 Seventh Street, 1973.

* The Last Whole Earth Catalog. Access to Tools, Menlo Park, California, Whole Earth Catalog, 588 Santa Cruz Avenue, 1971.

* Technology for Children Leather Teachers Manual. Philadelphia, Pennsylvania. Tandy Leather Co. 124 South 13th Street, 1972.

* Elementary School Learning Resources for Career Education. "Putting It All Together," Edison, New Jersey - New Jersey Occupational Resource Center, New Jersey Residential Manpower Center, Building 871, Plainfield Avenue, Edison, New Jersey, 1973.

SUGGESTED RESOURCES

MATERIAL - EQUIPMENT SUPPORT

A Technology for Children Program operates to a large degree upon a rich material learning environment. Materials which invite exploration and finding out are preferred in the design of the learning environment. Any material which advances a child's learning is appropriate. Listed are several starting points through which exploration may be launched and supported. Suppliers are coded. (See Suppliers Listing for specific information.)

AREA	SUPPLIERS
AUTOMATION	ALL, ALR, BRO, CEN, GRA, HEA
AVIATION-AEROSPACE	BRO, EST, JLH, PAU, SEA, SNJ
CONSTRUCTION	BRO, CHI, COP, EDSI, FAR, FIS, MCG, POR, WBC, WOO, WOR
ECOLOGY	AME, BRO, CCM, CEN, ESAC, HAM, JLH, KIN, KUR, ROD, UNE, USI
ELECTRICITY	ALL, BRO, EDM, GRA, JLH, LAF, WBC
FOODS	BRO, CON, EDM, ESA, JLH, SEA
INCUBATOR	AML, CES, EDM, JLH
INERTIA	BEC, CON, MIL, SAR
MATHEMATICS	BRO, CHI, ESA, JLH, KUR, MAT, MCG
MEASUREMENT	BRO, CCM, CEN, CHI, EDM, EDS, HEA, JLH, KUR, MAT, MCG, SEA, SEE, SUP

AREA	SUPPLIERS
PAPER RECYCLING	BRO, HAM JLH, SEA, WBC
PHOTOGRAPHY	BRO, DPIS, EAS, JLH, SEE, WOR
PLANT SCIENCE	AME, CEN, EDC, EDM, ESAC, FAR, GEO, JLH, ROD, USI
PLASTICS	BRO, COP, GAA, IND, MUL, SUP, WEC
PRINTING	ADV, BEC, BRO, GRA, HEA, JLH, PRI, WOR
PRODUCT TESTING	BRO, CCM, CRI, EDM, JLH, SEA, WBC
PROPERTIES OF MATERIALS	AME, BRO, CEN, CHI, CRI, ESA, JLH, MCG, MIT, POR
RADIO MAPPING	BRO, HEA, JLH, MCG, MPS
SOUND	ALL, ALR, BRO, CEN, CON, CRPL, EDN, FAR, GRA, MUL
STRUCTURES	BRO, FAR, FIR, GRA, IND, ROL, WOO, WOR
TOOL MAKING I & II	BRO, GRA, JLH, MIT, WBC, WBF

TECHNOLOGY FOR CHILDREN

SUPPLIERS

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
ADD	Addison-Wesley Canada, Ltd. 57 Gervais Drive Don Mills, Ontario Canada	Literature
ADV	Advance Process Supply Co. 6900 River Road Pennsaukan, New Jersey 08110	Screen Process Printing
AGA	Agathon Press, Inc. 150 Fifth Avenue New York, New York 10011	Literature
ALL	Allied Electronics 2400 W. Washington Boulevard Chicago, Illinois 60680	Electrical-Electronic Supplier
ALR	Allied Radio Shack Independence Mail Shop. Ctr. 84 East State Street Trenton, New Jersey 08625	Electrical-Electronic Supplier
AMC	American Art Clay Company 4717 West Sixteenth Street Indianapolis, Indiana 46222	Clay-Ceramic Supplier
AME	American Science and Engineering 20 Overland Street Boston, Massachusetts 02215	Microscopes, Thermometers
ACE	Association for Childhood Education International 3615 Washington Avenue, N.W. Washington, D. C. 20016	Literature
BEC	Beckley-Cardy 1900 N. Narragansett Avenue Chicago, Illinois 60639	General School Equipment and Supplies
BEL	Bell and Howell Company Audio-Visual Products Division 7100 McCormick Road Chicago, Illinois 60645	Audio Visual Equipment and Supplies
BHG	Brodhead-Garrett Eastern Region One Industrial Road Woodridge, New Jersey 07075	General Industrial-Tool-Material Supplier
CAJ	C. A. Jones Publishing Company 698 High Street Village Green Worthington, Ohio 43085	Literature
CCM	Cambosco Incorporated 342 Western Avenue Boston, Massachusetts 02135	Science and Technological Equipment and Supplies
CUE	Center for Urban Education 105 Madison Avenue New York, New York 10016	Literature
CEN	Central Scientific Company 237 Sheffield Street Mountainside, New Jersey 07092	General Scientific-Technological Materials, Equipment
CHI	Childcraft Equipment Company, Inc. 155 East 23rd Street New York, New York 10010	Educational Equipment Supplier
CIT	Citation Press Scholastic Book Services 50 Est 44th Street New York, New York 10036	Literature
CON	Constructive Playthings 1040 East 85th Street Kansas City, Missouri 64131	General School Equipment and Supplies
CRI	Consumers' Research Inc. Washington, New Jersey 07882	Consumer Education
COP	Cope Plastics Illinois, Inc. School Sales Division 1111 West Delmar Avenue Godfrey, Illinois 62035	Plastics Supplies and Equipment
CRPL	Creative Playthings c/o Garrett H. Buchanan Co. 2020 Vultee Street Allentown, Pennsylvania 18105	Educational Equipment Supplier
CRPU	Creative Publications P.O. Box 10328 Palo Alto, California 94303	Math Materials

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
CUI	Cuisenaire Company of America, Inc. 12 Church Street New Rochelle, New York 10805	Math Materials
DPIS	Daily Photo and Industrial Supply Company 117 N. Wood Avenue Linden, New Jersey 07036	Photography
DIV	Division of Surveys and Field Services George Peabody College for Teachers Nashville, Tennessee 37203	Free and Inexpensive Aids to Educators Catalog
EPD	E. P. Dutton and Co., Inc. 201 Park Avenue, S. New York, New York 10003	Literature
ECES	Early Childhood Education Study Advisory for Open Education 90 Sherman Street Cambridge, Massachusetts 02140	Early Childhood-Elementary Education Advisory
EAS	Eastman Kodak Company 343 State Street Rochester, New York 14650	Photography
EDSI	Edcom Systems, Inc. 145 Witherspoon Street Princeton, New Jersey 08540	Educational Kits
EDM	Edmund Scientific Company 91 Edscorp Buiding Barrington, New Jersey 08007	General Scientific-Technological Materials Equipment, Kits
EDC	Education Development Center, Inc. 55 Chapel Street Newton, Massachusetts 02160	Educational Ideas, Literature and Materials
EKNE	American Association of Elementary-Kindergarten-Nursery Educators, NEA 1201 16th Street, N.W. Washington, D.C. 20036	Literature
ESA	Educational Supply Assoc., Ltd. School Materials Division P.O. Box 22 Pinnacles, Harlow Essex, England	General School Supplies

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
ESAC	Elementary Science Advisory Center University of Colorado Boulder, Colorado 80302	Ecology Outdoor Education
ESS	Elementary Science Study Education Development Ctr., Inc. 55 Chapel Street Newton, Massachusetts 02160	Elementary Science Program
EST	Estes Industries, Inc. Box 227 Penrose, Colorado 81240	Model Rocketry
FAR	Farallones Designs Star Route Point Reyes Stations California 94956	Literature Ideas
FER	Fernhill House, Ltd. 303 Park Avenue, S. New York, New York 10010	Literature
FIS	Fischer of America, Inc. 151 Forest Street Montclair, New Jersey 07042	Construction Kits
FOR	Ford Motor Company The American Road Dearborn, Michigan 48121	Educational Aids, Booklets, Films
FRI	Friden Division The Singer Company Princeton, Hightstown Rd. Princeton, New Jersey	Calculators
GAL	Galt and Company, Ltd. Brookfield Road Cheadle Cheshire, England	Elementary School Supplier
GAR	Garden State Audio Visual Co., Inc. 40 Livingston Avenue New Brunswick, New Jersey 08901	Video Equipment
GEC	George W. Park Seed Company, Inc. Greenwood, So. Carolina 29646	Gardening
GMC	General Motors Corporation Detroit, Michigan	Literature Transporation Aids

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
GRA	Graves-Humphreys, Inc. 1948 Franklin Road P.O. Box 1240 Roanoke, Virginia 24006	General Industrial, Tool, Material Supplier
HAM	Hammermill Paper Company P.O. Box 1440 Erie, Pennsylvania 16512	Educational Aids for Paper
HUP	Harvard University Press Kittridge Hall 79 Garden Street Cambridge, Massachusetts 02138	Literature
HEA	Heathkit Electronic Center 6318 Roosevelt Boulevard Philadelphia, Pennsylvania 19149	Electrical-Electronic Kits
HEW	Hewlett Packard 1060 North King Highway Cherry Hill, New Jersey 08034	Electronic Equipment
HUB	Hubley Manufacturing Company Scale Model Division Lancaster, Pennsylvania 17604	Models
IDEA	IDEA P.O. Box 446 Melbourne, Florida 32901	Educational Ideas, Films, Literature
IND	Industrial Arts Supply Company 1408 West Lake Street Minneapolis, Minnesota 55408	General Industrial Arts Supplies
JLH	J. L. Hammett 2393 Vaux Hall Road Union, New Jersey 07083	General School Supplies
JOH	John Wiley and Sons, Inc. 605 Third Avenue New York, New York 10016	Literature
KC	The Kelsey Company Meriden, Connecticut 06450	Printing Equipment & Supplies
KIN	King Features Education Division of Special Services 234 East 45th Street New York, New York 10017	Career Education Literature

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
KUR	Kurtz Brothers Eastern Division 1001 Cassatt Road Paoli, Pennsylvania 19301	General School Supplies
LVE	Lab Volt Educational Systems P.O. Box 323 Sea Bright, New Jersey 07760	Electrical-Electronic Equipment
LAF	Lafayette Radio Electronics 111 Jericho Turnpike Syosset, Long Island New York 11791	Electrical-Electronic Supplier
LAP	LaPine Scientific Company 375 Chestnut Street Norwood, New Jersey 07648	General Science Supplies
LET	Learning Tree P.O. Box 2650 Hamilton Square, New Jersey	Tri-Wall, Educational Materials
MAC	MacMillan Company Mail Order Department 886 Third Avenue New York, New York 10022	Literature
MAG	Magnamusic - Baton, Inc. 6390 Delmar Boulevard St. Louis, Missouri 63130	Musical Instruments
MAT	Math Media, Inc. P.O. Box 345 Danbury, Connecticut 06810	Math Materials
MCG	McGraw-Hill Book and Education Services McGraw-Hill, Inc. 330 Est 42nd Street New York, New York 10036	Literature
MIT	Massachusetts Institute of Technology Cambridge, Massachusetts 02142	Literature
MPS	Map and Pbblications Sales Office Bureau of Geology P.O. Box 1889 Trenton, New Jersey 08625	Geological Survey Maps
MER	Merry Thoughts, Inc. Pelham, New York 10803	Literature

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
MID	Midwest Products 400 South Indiana Hobart, Indiana 46342	Model Aircraft
MIL	Milton Bradley Company P.O. Box 1581 Springfield, Massachusetts 01101	General School Supplies
MUL	Mulligan's Craft Supply Company P.O. Box 1022 Point Pleasant, New Jersey	General Art Supplies
NAESP	National Association of Elementary School Principals National Education Association 1201 Sixteenth Street, N.W. Washington, D. C. 20036	Literature Films, Tapes, Ideas
NAIS	National Association of Independent Schools 4 Liberty Square Boston, Massachusetts 02109	Literature
NCTE	National Council of Teachers of English 1111 Kenyon Road Urbana, Illinois 61801	Literature
NEW	Newcomb Audio Products Company 12881 Bradley Avenue Sylmar, California 91342	Audio Visual
PC	The Paige Company 432 Park Avenue New York, New York 10016	Storage Boxes
PAU	Paul K. Guillow, Inc. Wakefield, Massachusetts 01860	Model Aircraft
PEN	Pendragon House, Inc. 1093 Charter Avenue Redwood City, California 94063	Supplier-British Government Publications
POR	Portola Institute 1115 Merrill Street Menlo Park, California 94025	Literature, Ideas
PRE	Prentice Hall, Inc. Route 9, West Englewood Cliffs, New Jersey 07632	Literature
PRI	Prior Typewriter Company 232 East StateStreet Trenton, New Jersey 08608	Typewriters
ROD	Rodale Press Emmaus, Pennsylvania 18049	Nutritional Environmental-Ecological Literature
ROL	Rolfe Buiding Supply Company 40 Jersey Avenue New Brunswick, New Jersey 08903	General Building Construction Supplier
SAR	Sargent-Welch Scientific Company 35 Stern Avenue Springfield, New Jersey 07081	General Science Supplies and Equipment
SEA	Sears, Roebuck and Company Roosevelt Boulevard Philadelphia, Pennsylvania 19132	General Supplies and Equipment
SEL	Selective Educational Equipment 3 Bridge Street Newton, Massachusetts 02195	Math and Science Supplies Kits Units
STA	Standard Safety Equipment Company 13 Hackel Street Be[illegible]le, New Jersey 07109	Safety Glasses and Equipment
SNJ	State of New Jersey Department of Labor and Industry Bureau of Engineering and Safety 1100 Raymond Boulevard Room 419 Newark, New Jersey 07102	N.J. Model Pockets Permits
SOC	Sony Corporation of America 4747 Van Dam Street Long Island City New York 11101	Television Electronics
SUP	Superintendent of Documents United States Government Printing Office Washington, D. C. 20407	Literature
TAN	Tandy Leather 124 S. 13th Street Philadelphia, Pa. 19107	Leather and Supplies

CODE	SUPPLIER AND ADDRESS	MATERIAL AND/OR SERVICE
TEA	Teachers College Press Columbia University 1234 Amsterdam Avenue New York, New York 10027	Literature
TIM	Time - Life Films 43 West 16th Street New York, New York 10017	Literature, Films
TRE	Trent Box Inc. Yardville Hamilton Square Road Hamilton Square, New Jersey 08690	Tri-Wall
TYC	Tyco Industries, Inc. Woodbury Heights New Jersey 08098	Models
USI	Urban Systems, Inc. 1033 Massachusetts Avenue Cambridge, Massachusetts 02138	Ecology Kits, Games
UNE	UNESCO United Nations New York, New York	Literature
VID	Video Systems Corporation 7300 N. Crescent Boulevard Pennsauken, New Jersey 08110	Closed Circuit Television
VIN	Vintage Books Random House 201 East 50th Street New York, New York 10022	Literature
WEC	Warner Electric Company, Inc. 1512 Jarvis Avenue Chicago, Illinois 60622	Plastic Laminating & Rubber Stamp Outfits
WBC	Warren Balderston Company 1321 Princeton Avenue Trenton, New Jersey 08606 ATTN: Mr. William Heffner	Tools
WEL	Welch Scientific Company 609 West 51st Street New York, New York 10019	Scientific- Technological Equipment & Supplies
WBF	Wilkie Brothers Foundation 254 No. Laurel Avenue Des Plaines, Illinois	Tools- Invention Literature
WOL	Wollensak 3M Company 3M Center St. Paul, Minnesota 55101	Audio Visual Equipment
WOS	Wolverine Sports 745 State Circle Ann Arbor, Michigan 48104	Sporting Goods
WOO	Woodcraft Supply Corporation 313 Montvale Avenue Woburn, Massachusetts 01801	Tools i.e., Wood Threading Kits
WOR	Workshop for Learning Things 5 Bridge Street Watertown, Massachusetts 02172	Classroom Ideas, Kits Booklets, Materials

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P. 15 Robert M. W. Travers, "Directions for the Development of an Educational Technology" in Technology and the Curriculum, Paul W. F. Witt, editor. (New York: Teachers College Press, copyright, 1968 by Teachers College, Columbia University) P. 93.

P. 29 Saltrick, Daniel F. and A. Kubota. Aerospace, Education and Model Rocketry - An Educator's Guide for Grades Four Through Ten. Penrose, Colorado: Estes Industries, 1970.

P. 43 Elementary Science Study. Batteries and Bulbs II, Newton, Massachusetts, E.S.S. Education Development Center, Inc., 1969.

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P. 97 Hawkins, David. Mountain View Center for Environmental Education. University of Colorado, Boulder, Colorado and appearing in THE ESS READER, Education Development Center, Inc., Newton, Massachusetts, 1970.

P. 99 From the book "THE PROFESSIONAL AMATEUR" (The Biography of Charles Franklin Kettering). Edited by T. A. Boyd. Copyright, 1957, by T. A. Boyd. Published by E. P. Dutton and Co., Inc., and used with their permission.

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P. 111 George H. Frien, "Curriculum: A Plea For Play," Insights, Grand Forks: Center for Teaching and Learning, University of North Dakota, IV:3, November, 1971.

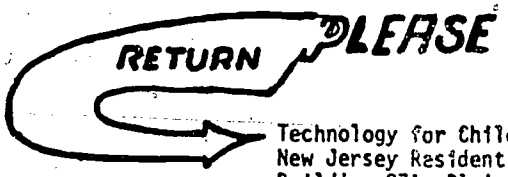
GETTING STARTED

After you have worked with the booklet and ideas for a reasonable period, please help us by completing this follow-up survey. Assess the value to you and your classroom activities. + is high use, 0 is little use, and - is no use. Then send it to us at the address shown. Thank you!

Date	School	District	Grade	Teacher

	CHECK VALUE OR WORTH	+	0	-	← Mark an X if you used the activity
1. AUTOMATION	An Automatic System				
2. AVIATION-AEROSPACE	Aircraft				
	Flying Kites				
	Rocketry				
3. CONSTRUCTION	Building with Cardboard				
4. ECOLOGY	Air Quality Sampling				
5. ELECTRICITY	Batteries & Switch Ideas				
	Heat				
	Light				
	Motion				
6. FOODS	How to Make Butter				
	Solar Cooker				
	Something Different				
	Taste Preference				
	Testing Food for Starch				
7. INCUBATOR	From Egg to Chick				
8. INERTIA					
9. MATHEMATICS	Calculators				
	Calculators-Binary				
	Geoboards				
	Math Materials				
	Math Games				
10. MEASUREMENT	Altitude-Clinometer				
	Balance				
	Falling & Rolling Objects				
	Linear				
	Personal				
	Personal Pace Scale				
	Pulse Rate				
	Think Metric!				
11. PAPER RECYCLING					
12. PHOTOGRAPHY					
13. PLANT SCIENCE	"Experiment-Station"				
	Soil Testing				
14. PLASTICS	Processes				
15. PRINTING	Letterpress				
	Screen Process				
16. PRODUCT TESTING	Ball Bounce				
	Canned Fruit				
	Comparisons-Labels				
	"D" Cell 1.V Batteries				
17. PROPERTIES OF MATERIALS	Sand and Water				
18. RADIO MAPPING					
19. SOUND	Cigar Box Violin				
	Develop a Xylophone				
20. STRUCTURES	Shapes				
21. TOOL MAKING I					
II					
22. WORK AND PLAY	Some Thoughts				
CONTENT CATEGORIES					
A. INTRODUCTION					
B. INTEREST LEARNING	Ideas & Suggestions				
C. CHILDREN TOOLS AND LEARNING					
D. CLASSROOM ORGANIZATION	Arrangement Ideas				
	Physical Arrangements				
	Pupil Logs-Journals				
E. DEVELOPING A SAFETY PHILOSOPHY					
F. INTEREST AREAS					
G. FREEBIES					
H. SUGGESTED RESOURCES					
I. SUPPLIERS LIST					
J. PERIOD OF TIME BOOKLET WAS USED:					

SUGGESTIONS FOR:
* Modifications
* Alternatives



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