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ABSTRACT

This draft collection of energy education units is intended for use from elementary grades through middle school grades. It contains 17 units addressing current energy issues. Each activity includes an activity description, objectives, content, materials list, vocabulary list, energy concepts, and further information to aid the teacher in incorporating the information into the overall curriculum. Patterns and copy masters are included. (RE)

BTU TEACHER DEVELOPED ENERGY MATERIALS FOR ELEMENTARY & MIDDLE SCHOOLS

BETTER THAN USUAL

DRAFT

BTU* TEACHER DEVELOPED ENERGY MATERIALS FOR ELEMENTARY & MIDDLE SCHOOLS

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*P = Primary, I = Intermediate, M = Middle School

HOW ENERGY IS USED THROUGHOUT THE SEASONS

by Ada Botts

HOW ENERGY IS USED THROUGHOUT THE SEASONS

ACTIVITY: Home checklist of energy use by the child. Posters to stimulate discussions of energy use as varying with the seasons.

ACTIVITY DESCRIPTION:

Checklist the child makes around the house as to how he uses energy throughout a day or a week. Eight posters showing indoor and outdoor scenes - relate this to energy usage; show that each season has its own requirements. Point up conservation possibilities through discussion of alternatives and options.

OBJECTIVES:

The child will be able to state alternatives and options that increase efficiency and help change from a "disposable" society. The child will be aware of his part as a consumer through a checklist.

CONTENT:

The child is a consumer. Help him to realize that he can make choices that can make a difference. Energy used in the home and outdoors can be saved by using wise thinking based on some knowledge, precautions, and looking into possible alternative activities.

MATERIALS:

Checklist, posters (8), trade books: seasonal topics and settings, magazines.

VOCABULARY:

energy, electricity, gas, oil, human energy, solar energy, consumer, conserve, disposable, thermostat, purchased energy (oil, gas or electricity), substitute.

STRATEGY:

Send checklists home. Might wish to include a cover letter stating the purpose for collecting this information. Discuss and work

through results and come to any conclusions of the group. Talk about being consumers; how one might be a wise consumer. Throughout, read books with seasonal settings and happenings.

ENERGY CONCEPT:

We use energy within and outside the home. There are ways we can conserve energy.

SUBJECT INTEGRATION:

Science: Season Unit, Ecology and Energy unit.

Social Studies: Family Living

EXTRA SUGGESTIONS:

Use Trend season sets of posters with suggested activities. Have a bulletin board ready for use after topic discussion that the children can design. For use with the posters: Have small objects cut out that can be added to the poster as the discussion leads to other suggestions.

FOLLOW-UP ACTIVITIES:

Build a bulletin board: structure of a house or outdoors, cut from magazines and place in scene. Compare activities: this/not this. Child can draw his own picture with the things he would like to do. Make "I can make the difference" energy posters; demonstrating energy wise choices, alternatives, activities that are energy savers.

Seasonal Activities:

Autumn: Go on a nature walk
Check your house
Learn some crafts or leisure time activities as alternatives to television.

Winter: Make ice cream with snow
Winter activities for long cold winter evenings
Clothing unit

Spring: Learn new games-marbles, jump rope rhymes.
Make kites, pinwheels

Summer: Talk about neighborhood or nearby vacation spots
Work out some activities for summer fun with books or games and friends.

End of the year: Draw conclusions about what we have found out
Wind up with any conclusions

Look at all the seasons - which was most energy wasteful?
Did we find ways to help save energy?

QUESTIONS FOR DISCUSSION OF CHECKLIST:

Food:

Graph the results of appliance use.
Did we use energy to eat food?
At what meal might we have used the most energy?

Toys:

What kinds of toys do we like to play with?
Do we use the energy using toys as much or as long?
Do we have more toys that use purchased energy to run than human energy?

Entertainment:

What kinds of activities do you do for fun with your family?
Does it take energy to do them all?
What kinds of energy do we use?
How could we use less energy? open ended
List energy users versus energy saving activities on the board from children's suggestions.
Would it be possible to exhange one activity from this side of the chart for another on that side of when our family wants to do something?

Work:

How many of you do chores at home for your family?
Are you helping to save energy with the work you do?
Let's look at our checklist and find out:

Leisure:

Kids like to do different things with their spare time.
What do you like to do in _____ (insert present season)
Let's see what we like to do in our spare time.
Did it take purchased energy to do most of these things?
To save energy how can we change this?

CHECKLIST

DIRECTIONS: What did you do today? What did you do this week? Have someone in your family help you fill this out. Put a ____✓____ on the line if you do or like this.

FOOD: What did you eat today?

____ice cream	____peanut butter	____milk
____grapes	____egg	____juice
____apple	____bacon	____orange
____pear	____bread	____banana
____corn	____pizza	____beans
____carrots	____cereal	____potatoes
____chicken	____potato chips	____lettuce
____hamburger	____pretzels (popcorn)	____hot dog
____crackers	____jelly	____cake

Did you use these to prepare the food? (Did your mom use them?)

____oven	____toaster	____can opener
____stove	____blender	____blender
____refrigerator	____popcorn popper	____freezer
____teakettle	____microwave	

ENTERTAINMENT: What does you family like to do together? Check the answers that apply to you.

At home:

____watch T.V.	____listen to record player	____play games
____read	____do crafts	
____listen to the radio	____play instruments	____watch slides

Away from Home:

____go to the movies	____go for a drive	____visit friends

_____eat out

_____travel to far off places

_____go to the zoo

_____go to the museum

_____to to the library

TOYS: Which of these do you own? Think about which you use the most.

_____cars and trucks

_____record player

_____swings

_____games

_____electric train

_____dolls

_____jump rope

_____puppets

_____bicycle

_____building sets

_____balls

_____books

_____battery operated toys

WORK: Which of these do you do around the house? Think about if you are helping to save energy as you do them.

_____rake leaves

_____hang out the clothes

_____weed the garden

_____mow the lawn

_____shovel snow

_____make your bed

_____wash dishes

_____plant the garden

_____vacuum the floor

_____unload the dryer

_____empty the dishwasher

_____set the table

_____sweep

_____feed pets

_____dry the dishes

_____go the the store

_____pick up toys

LEISURE: Which do you like to do? Do the activities take people or purchased energy? Which do you do at this time of the year?

_____read

_____tennis

_____fly a kite

_____cross country ski

_____swimming

_____jacks

_____jog

_____sailing

_____hike

_____bike

_____baseball

_____camp

_____watch T.V.

_____canoeing

_____fishing

_____cook

_____hockey

_____roller skate

_____snowmobile

_____ice skate

_____sledding

_____badminton

_____play outside

_____play board games

Others: _____

_____

_____

Questions for General Discussion after the Checklist or at Other Times.

Are you a consumer? (Discuss what a consumer is. Give accurate and sufficient examples of instances.)

Would you like to make a wise choice for your own happiness? Would you like to be sure that what you buy is what you really want and that you will be happy with your choice?

Would you like to learn to make wise decisions for yourself?

Here are some questions to think over and remember if you agree that they will help you make your choice.

Most important: Do I really need it to be happy?

What could I use instead or could I make do with a substitute?

How long will it last?

Have my friends or kids my own age enjoyed the same thing or could they tell me bad things about it?

About how long do I think that I will enjoy using it?

Can it be recycled? How?

Will it take energy to use it? What kind of energy?

Might it cause damage to the environment?

Questions to be Used with Energy Posters

General questions to be used with each poster:

Indoors: What season is it?

What changes do you see in the house? Do you see some things that use energy? Have the people done anything to prepare the house for this

season? What do you have in your house that can't Be seen here? Do you have any suggestions for ways to save energy here?

Outdoors: What season is it?

How will the weather affect what we can do? Where might we be spending much of our time? What can we do for fun? Allow time for brainstorming and discussion. List these on the board.

What kinds of energy did each of these activities take?

What changes could we make to use less energy?

AUTUMN

Indoors: thermostat up, windows closed

Outdoors: football, bicycle, jump rope, hike, fish,

WINTER

Indoors: electric blanket, refrigerator, stove, clocks, lamps, T.V., washer, telephone, and fireplace, candles.

Changes for weather: curtains, storm windows, thermostat up
Suggestions: Keep thermostat at 68°. Use storm doors and storm windows. Wear extra clothing and put extra blankets on beds. Use more human energy - to shovel.

Outdoors: Ice skate, sled, snowmobile, snowman, ski, hockey, etc.

SPRING

Indoors: curtains down, windows open

Outdoors: marbles, fishing, gardening, plant garden, jump rope, baseball, soccer, swinging.

SUMMER

Indoors: air conditioner, curtains down, thermostat turned down, pool, screens up.

Outdoors: swimming, tennis, badminton, fishing, biking, swinging, jump rope, marbles, hide and seek, picnicking.

NOTE: Art work for posters will be given out separately. The posters include indoor and outdoor scenes for each season. (Eight posters in all.)

CHECKING HOME FOR KINDS OF ENERGY USED AND FOR APPLIANCES AND HEATING SYSTEMS WHICH USE THIS ENERGY

by Judy Hetherington

ACTIVITY: Checking Home for Kinds of Energy Used and for Appliances and Heating Systems which use this energy. (Lower elementary)

ACTIVITY DESCRIPTION:

Student and parent will "tour" home together to see where energy is channeled into the home. They will mark a check list showing what major appliances and heating system they have and what energy makes each work.

ENERGY CONCEPT:

Different kinds of energy "work" for us in our home.

OBJECTIVE:

Awareness: After finishing this activity each student will be able to name the types of energy used in his/her home. Each student will be able to list the type of heating system and at least three home appliances and to name the energy used to operate them.

CONTENT:

Students need to be aware of how energy is used in their homes before they can begin to realize how to conserve it.

MATERIALS:

(Included in unit), Letter to Parents, Checklist, Energy identification worksheet; Picture of a Meter.

VOCABULARY:

Appliance, natural gas, electricity, heating system, propane, meter.

USE IN CURRICULUM:

This activity is appropriate after the student is aware that we use different kinds of energy in our world today. It can be incorporated with social studies, health, safety units concerning self, home, community, or our world around us.

STRATEGY:

In class, the teacher leads discussion through questioning.

1. What keeps your home warm in winter? (Furnace, fireplace, electric heater, etc.)

2. Does the sun warm your home in the winter? (Stress that it warms our homes, even in winter - we don't have to channel it in. Discussion can touch upon solar homes.).

3. What keeps your home cool in summer? (Air conditioning, fan.)

4. How do you keep food from spoiling? (Refrigerator, Freezer.)

5. How do your parents cook food? (Stove, micro-wave oven, grill)

6. We have many appliances. What makes them work? What makes your furnace heat? (Natural gas, oil, coal.) What makes the Air Conditioner, refrigerator, stove work? Where do you get hot water? How is the water heated?

7. How does that energy get into your house (apartment)? (Through wires, pipes, it's carried in as wood for fireplace, - a truck brings it.)

8. Have you ever looked to see these wires or pipes? Did you ever see a meter that measures our use of electricity or gas? (Show pictures of a meter. Tell students that a meter measures the energy used in their homes.)

9. We have a project that you and your mom or dad can do together at home. (Read letter to class. Show checklist and demonstrate its use. At close of day, pass out letters and checklists to be taken home.)

10. As incentive for return of checklist discuss plans for a display of checklists somewhere in classroom.)

11. At a later time follow-up questions can cover results of check-lists returned.

Questions:

What makes our houses warm? (Use results of checklist and write on board. Example: 5 oil furnaces, 18 natural gas furnaces, 3 electric furnaces, 14 fireplaces.)

How does your family cook food? (Continue to discuss check-lists results and compare numbers concluding by totaling to see what forms of energy are most commonly used. Use energy identification worksheet.

Dear Parents:

We are beginning to learn about energy in our class. Will you help? This project will take 10 or 15 minutes. We are asking each student to "tour" his/her home with a parent to see what kinds of energy are used. After showing your child where different sources of energy enter your house or apartment house, will you please complete the attached checklist and return it to school with your child?

Our purpose is to help each student become aware of the kinds of energy used in everyday living so that later, when we learn about energy conservation, students will know where the energy is used.

Each student's completed checklist will be displayed in our room. Your cooperation will be appreciated!

Sincerely,

ENERGY CHECKLIST: PLEASE RETURN TO SCHOOL WITH YOUR CHILD

1. Energy Used In Home

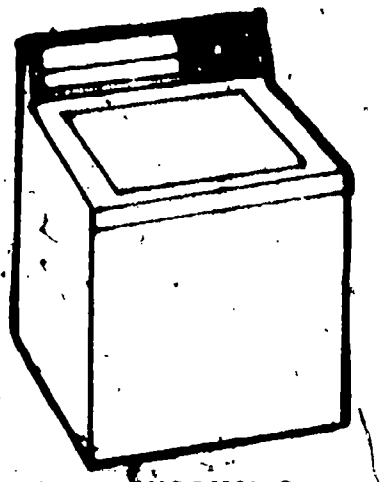
	Yes	Comments
Natural gas Electricity Oil Propane Coal Wood.		

2. Energy Used By Appliances and Heating System

	Natural Gas	Electricity	Oil	Propane	Coal	Wood
Furnace						
Fireplace						
Stove						
Washing Machine						
Dryer						
Refriger-ator						
Hot Water Heater						
Freezer						
Air Con-ditioner						
Television						
Dishwasher						
Garbage Disposal						
Stereo						
Humidifier						
Dehumidifier						
Other:						

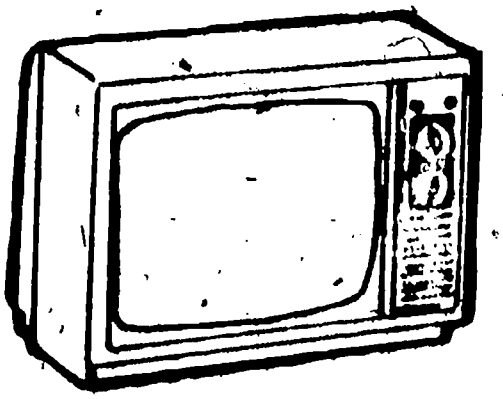
ENERGY IDENTIFICATION WORKSHEET

WHAT ENERGY IS USED IN YOUR HOUSE?

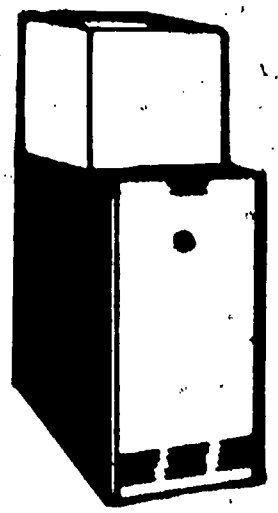


WASHING MACHINE

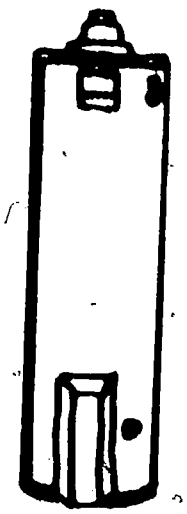
STOVE



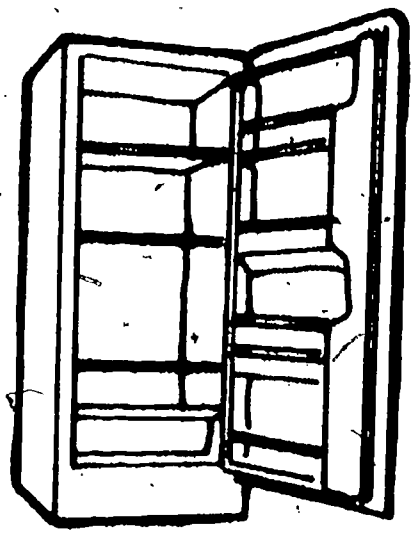
T.V.



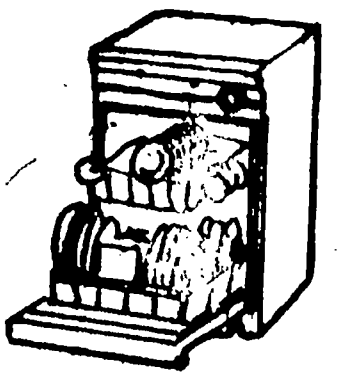
FURNACE



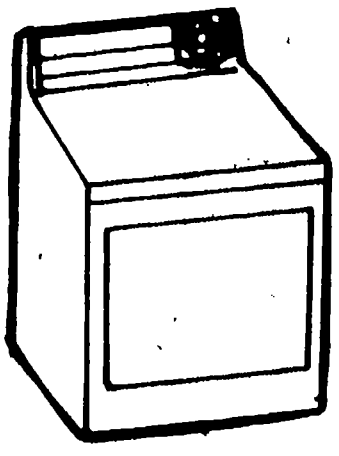
HOT WATER HEATER



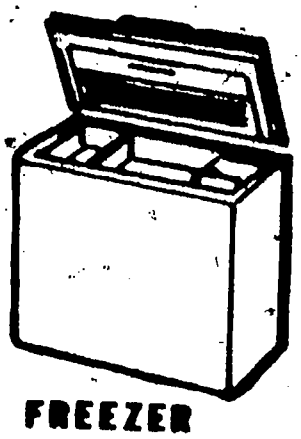
REFRIGERATOR



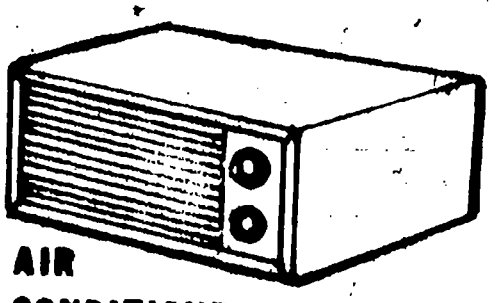
DISHWASHER



DRYER

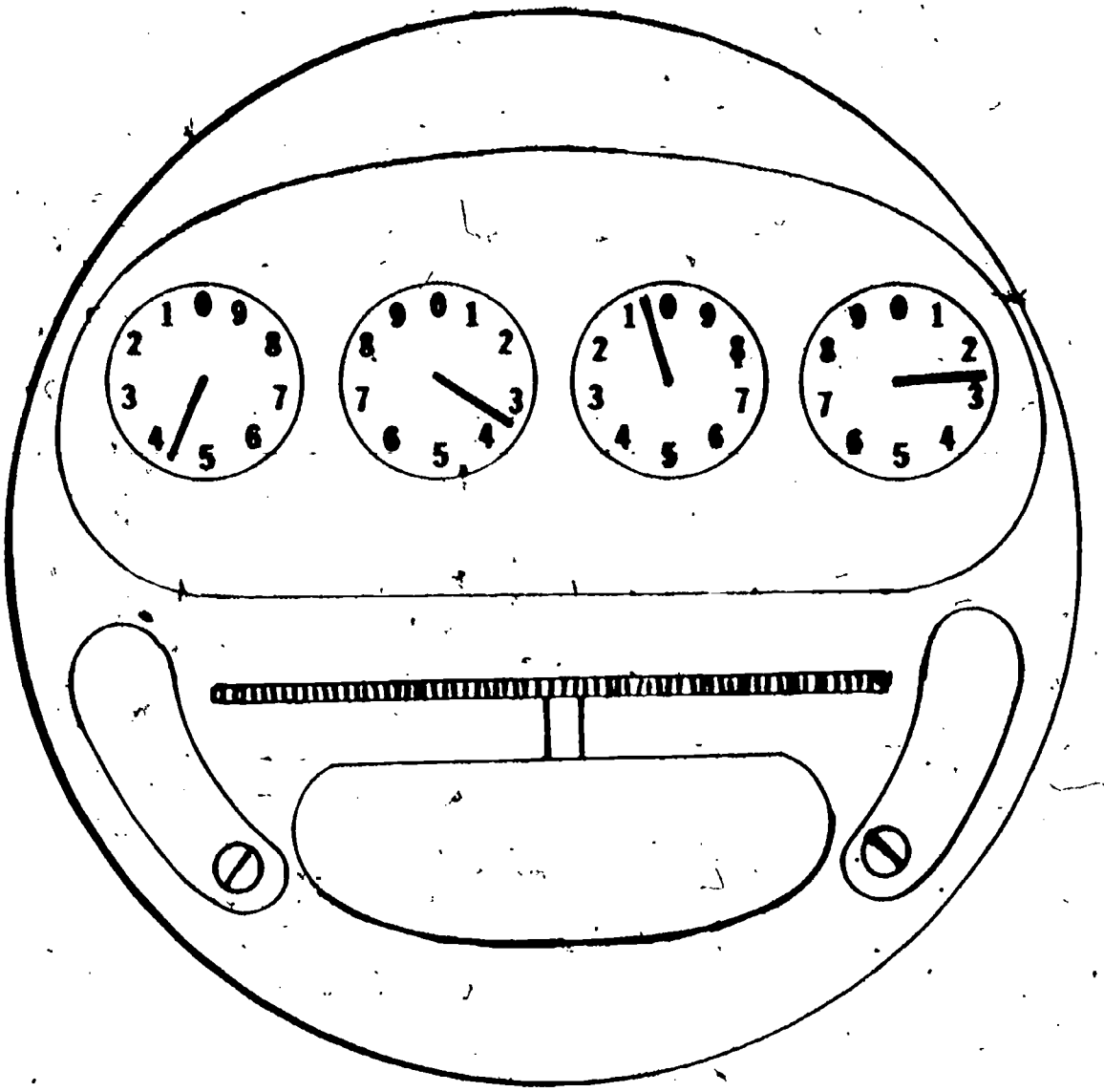


FREEZER



AIR CONDITIONER

NATURAL GAS -	COLOR RED
ELECTICITY -	COLOR BLUE
OIL -----	COLOR GREEN
PROPANE -	COLOR BROWN
COAL ----	COLOR BLACK



AL, THE ENERGY OWL - A STORY

By

Judy Hetherington

ACTIVITY: Al, The Energy Owl - A Story (Primary)

ACTIVITY DESCRIPTION:

This story is designed to be read aloud to children. Through the characters - Meg, Jonah, and Al, the Energy Owl, - the children will learn ways to be "energy-wise."

ENERGY CONCEPT:

Conservation of energy is something we all can do.

OBJECTIVES:

Students will be able to discuss ways they can conserve energy.

CONTENT:

Conservation is becoming the energy watchword for business, industry, government, school and citizens alike. Through conservation efforts, we can reduce energy use significantly and save precious resources for the future.

MATERIALS:

Story provided

possibly paper and crayons for follow-up activity

VOCABULARY:

	energy-wise	owl
fossil fuels	secret	

STRATEGY:

Read the story called "Al's Secret" aloud to the class. Discuss the ending questions, "Can you remember Al's secret? What will you do about it?"

As a follow up activity, you may want the children to draw a picture of what they will do to be "energy-wise" or to write a story about their own visit with Al, the Energy Owl. Try to encourage their use of"Al's Secret" in school. Maybe a bulletin board featuring Al, the Energy Owl will keep their interest alive.

AL'S SECRET

Meg and Jonah were cutting through the school yard on their way home one afternoon. Their path led them through a large clump of trees.

"This is like a forest," said Jonah.

"Sort of," answered Meg. "Look how tall these trees are!"

"Hey, look up there!" Jonah was excited. "See that bird? It's an owl!"

"You're right! Look how still he sits. Doesn't he look wise?" asked Meg.

"Everybody talks about the wise old owl. I wonder if owls are really so wise?" Jonah sounded doubtful.

The children had stopped for a better view of the owl. For a few minutes they gazed quietly upward.

All at once there was a flapping of wings. Down fluttered the owl, lazily. He perched on a branch at their eye level. Jonah and Meg were so surprised, they were speechless.

After a moment of silence, Meg and Jonah were amazed to hear the owl speak.

"I am wise in some ways. Of course, I don't know everything." He blinked his eyes solemnly.

"He's smart enough to talk, anyway," said Meg.

"Just who in the world are you?"

"I am Al," said the owl. He inched down the branch, scooting first one foot and then the other.

"I'll tell you a secret. I can help you to be wise in a very special way." He peered right into Meg's face. Then he gazed at Jonah.

"You, too," he said.

"What do you mean?" asked Jonah.

"I am Al, the Energy Owl. I can help you to be energy - wise."

"Energy-wise? What does that mean?" inquired Meg.

"It means that I can tell you how to be wise about energy. You know, people are using the world's supply of oil and gas--the fossil fuels--so fast that they'll run out if they aren't careful: I mean really careful."

"You say you can help us be energy-wise. Does that mean you can tell us how to save energy?" asked Meg.

"See?" chirped Al. "You are starting to catch on already." He stretched his wings out. A couple of grey pin feathers drifted to the ground." I could tell right away that you two have some smarts."

Jonah smiled. "We talk about energy at school," he said. "We talk about saving it, too."

"Good," said Al. "You're on the right track already. Let's list some ways boys and girls can be energy-wise."

"Well, we can turn out lights that aren't needed," said Meg.

"We can be sure to close the refrigerator door as quickly as possible," added Jonah.

"We can ride our bikes or walk, instead of asking for a ride from our parents----that is, if it isn't too far or if traffic isn't too heavy." Meg twisted her braids as she spoke.

"We can see that doors are shut in winter. If a friend comes over, we should just invite him right in so the door can be shut. That way warm air won't go out the door."

"You two have done a great job of thinking about saving energy. But there's a secret."

"Oh;good. I love secrets. What is it?" Meg was about to jump out of her Adidas.

"Well," began Al, "When we first began talking, I said I could help you to be energy-wise. But I can't make you energy wise. The secret is, you both have to do it all yourselves. You can talk all day, but if you don't do the things we listed, it dosen't count. The secret is doing. Then you will be energy-wise."

"Oh, Meg, we'd better go. Our families will worry if we aren't home by 4:00," Jonah realized that they had been talking to Al for quite awhile.

"Al, will we see you again? We always walk home this way." Meg hoped to be able to tell Al all of the energy saving things she was sure she would do.

"You might see me, but don't count on it. I need to help as many boys and girls as possible. But I'll watch for you two. Just remember the secret of being energy-wise." Al stretched his wings and flew toward the tree tops, then away to the sky. Soon he was just a dot and then he was gone.

"Oh, Jonah, do you think we can remember Al's secret?" asked Meg.

"We'll try," said Jonah.

The two children walked on home. Can you remember Al's secret? What will you do about it?

THE END

"THE MAGIC GLASSES" - A FLANNELBOARD STORY

by Debbie Johnson

ACTIVITY: "The Magic Glasses" - a flannelboard story (Grades: 1-3)

ACTIVITY DESCRIPTION:

Students hear a story about a future with decreased energy availability and therefore, decreased energy consumption.

ENERGY CONCEPT:

We all must conserve energy in our everyday lives.

OBJECTIVE:

After hearing the story, the student will be able to name or draw one way he/she can save energy in his/her own life. Hopefully the student will put this into practice.

CONTENT:

Energy is used for many things. Not conserving energy now may lead to decreased energy supplies in the future. The decreased availability of energy will alter our current life-style.

STRATEGY:

1. Prepare the flannelboard, cut-out figures, and magic glasses. Directions for these follow on a separate page.

2. Introduce the story by having the children name some things that use energy. Ask them if they have ever wondered what could happen if we didn't have as much energy to use anymore. Tell them the story is about life without much energy.

3. Make sure each child has his/her own pair of magic glasses. The students need them for the story.

4. Tell the story.

5. Discuss the story. Ask questions such as:

   a. Would you like to live like Tammy and Jason had to? Why? Why not?

   b. How did things change for them in the future?

   c. By saving, or conserving, energy now, we can help make sure we have enough for the future. Is that important? Why? Why not?

d. What are some things we can do to conserve energy at home and at school? Have each student think of one way he/she can conserve energy and then make a class list or have each student draw a picture of their energy-conservation measure.

MATERIALS:

1. Flannelboard
   a. Plywood - about 75 cm x 100 cm (30" X 40")
   b. Cotton flannel - enough to cover the plywood

2. Cut-out figures
   a. Cut-out patterns
   b. Construction paper - various colors
   c. Felt pen
   d. Sandpaper
   e. Glue

3. Magic glasses (1 pair/child) - tagboard

4. Story - "The Magic Glasses"

VOCABULARY:

energy recycle conserve

DIRECTIONS FOR THE MAGIC GLASSES:

The illustrations for the story are cut-out paper figures. The cut-outs can not always be in scale. They will be found after the story's text. It is best to make them from construction paper of different colors. Small details can be added by using a felt pen. Glue a strip of sandpaper to the back of the cut-out. This will make it stick to the flannelboard better.

To make the flannelboard, cover a piece of plywood with cotton flannel.

Use tagboard to make the magic glasses.

The words in the text having all capital letters are the cut-outs. The cut-outs should be placed on the board as they occur in the story, unless indicated otherwise. The cut-outs needed for each story are listed at the beginning of each part.

THE MAGIC GLASSES: Story

PART I

Cut-outs:

a. girl (2)
b. school bus (3)
c. boy (1)
d. car (4)
e. Mr. Save(5)
f. magic glasses - large (6)

As TAMMY walked to the bus stop, she wondered who the special visitor at school was going to be. Just as she thought she knew, the SCHOOL BUS pulled up. Tammy hopped on. She couldn't wait to get to school to find out if she was right.

When she got there, she saw JASON getting out of his mother's CAR. (He got up too late to ride the bus.)

They went inside. Everyone was trying to figure out who the special visitor was. A few minutes later, their guest arrived. The teacher said, "This is MR. SAVE, our special guest. He has something really interesting for you to do."

"Good morning, everyone," said Mr. Save. "How many of you would like to see into the future?" Everybody raised their hand. "In order to do that, you will need to wear a pair of MAGIC GLASSES like these. When you put them on, you will see what might happen if all of us don't start saving energy now."

(Pass out the magic glasses if you haven't already done so. Have the children put them on. Continue the story when everyone is ready).

Part II

a. boy(1)
b. boy's magic glasses(13)
c. television(9)
d. lamp(8)
e. clock (7)
f. refrigerator(14)
g. power plant (10)
h. coal(11)
i. boy carrying wood (15)
j. stove(12)
k. washing machine (18)
l. boy hanging up clothes (16)
m. boy sorting trash(17)
n. trash barrels (bottles, paper, cans) (19)

When JASON put on his MAGIC GLASSES, he found himself back at home. Suddenly, something strange happened. The TELEVISION went off. So did the LAMP and ELECTRIC CLOCK. Even the REFRIGERATOR stopped. In fact, everything that was electric just quit. The POWER PLANT ran out of coal so it couldn't make electricity anymore. A few hours later, a train would bring some more COAL to the power plant so it could make electricity again. It was hard to keep finding coal. Next, Jason saw himself CARRYING WOOD in for the WOOD-BURNING STOVE. The electric range was gone. The new stove was used to help heat the house as well as for cooking. Then Jason saw his mother doing the wash. The WASHING MACHINE was new, too. It had a handle that his mother was turning to squeeze water out of the clothes. After this, Jason saw himself HANGING THE CLOTHES UP on the clothesline. There wasn't enough electricity for the dryer anymore. A few minutes later, Jason saw himself SORTING TRASH in the basement. He was putting bottles in one BARREL, paper in another BARREL, and cans in still another BARREL. Soon a truck would come to pick them up and take them to the recycling center. The center made new things out of old things.

Part III

a. girl (2)
b. girl's magic glasses (13)
c. girl working in garden
d. house
e. man walking (23)
f. bicycle rider (22)
g. train (24)
h. car-crumpled (20)
i. bus-crumpled (21)
j. sun (25)

When TAMMY put on her MAGIC GLASSES, she found herself working IN HER FAMILY'S VEGETABLE GARDEN. Lots of people had gardens because it was sometimes hard to get food at the store. Next, Tammy saw her HOUSE. There were some funny-looking things on the roof. These things trapped heat from the SUN.

The sun's heat was used to heat water for showers, washing dishes, and other things that need hot water. Tammy decided to look around the neighborhood. She saw kids and ADULTS WALKING, RIDING BIKES, and taking the TRAIN. There were hardly any buses or cars. When she saw the junkyard, she found out why. It was full of CARS and BUSES that were going to be crushed. Afterwards, they would be taken to a place where they would be melted and then made into new steel. They were being recycled, too. Gasoline cost too much for most people to buy.

Part IV

a. Mr. Save (5) b. boy (1) c. girl (2)

(Put these up before beginning Part IV.)

"Well, boys and girls, it's almost time for me to go," Mr. Save said.

"Already?" said Jason.

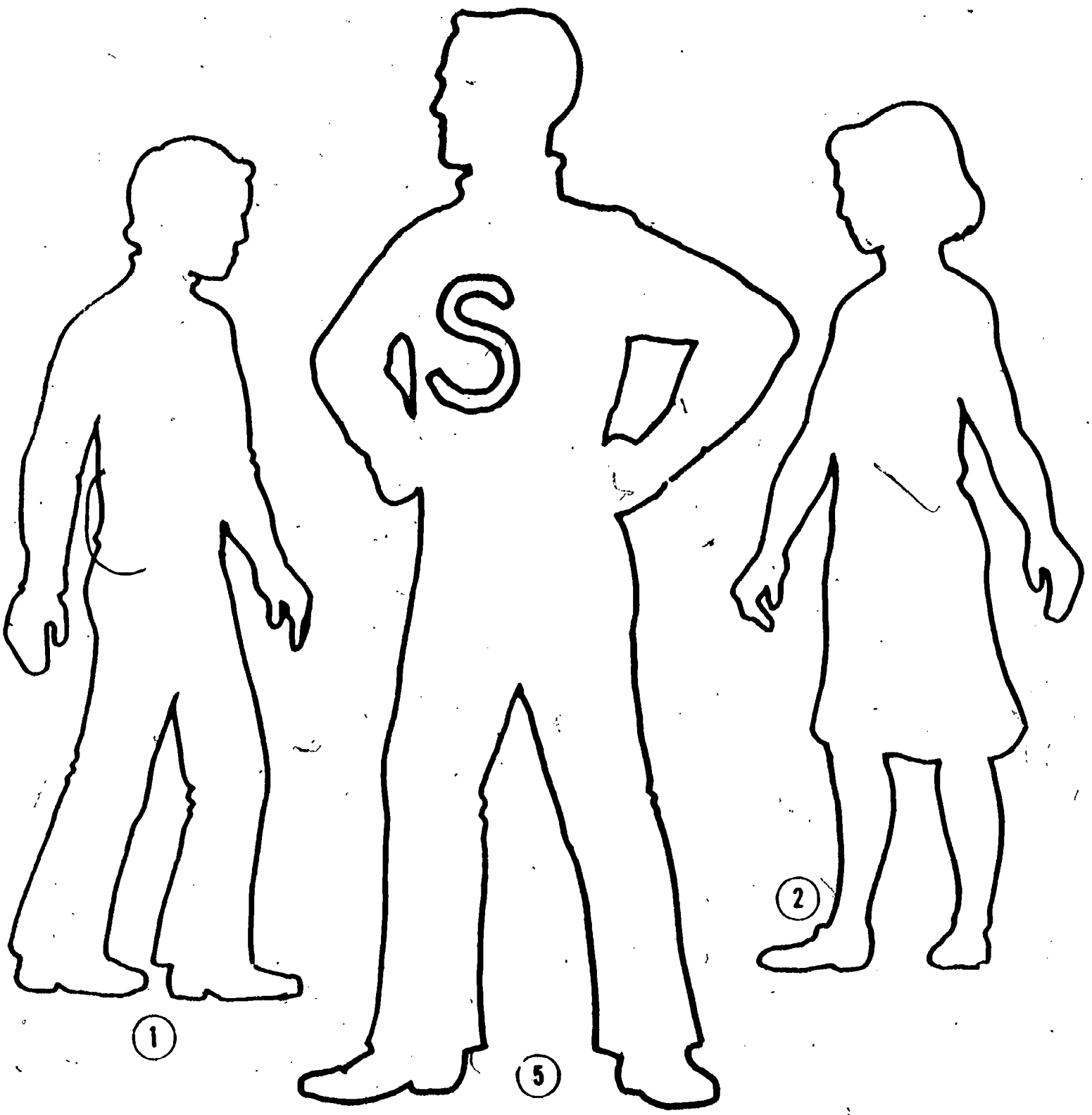
"I'm afraid so," said Mr. Save. "I hope you learned that energy is very important to all of us because we use it in almost everything we do. If we don't start saving it now, there might not be enough for us in the future. That's why all of us need to start saving right away."

"I've been hearing a lot about conserving energy. Is that the same as saving it?" asked Tammy.

"That's right," answered Mr. Save. "When we save energy by using less of it, we say we are conserving it."

"Thank you for Coming, Mr. Save. I never realized that we use energy in so many ways. We use it for just about everything we do," Jason added.

After Mr. Save left, the class asked their teacher if they could make a list of ways to save energy at home and at school. They came up with lots of good ideas. CAN YOU??????



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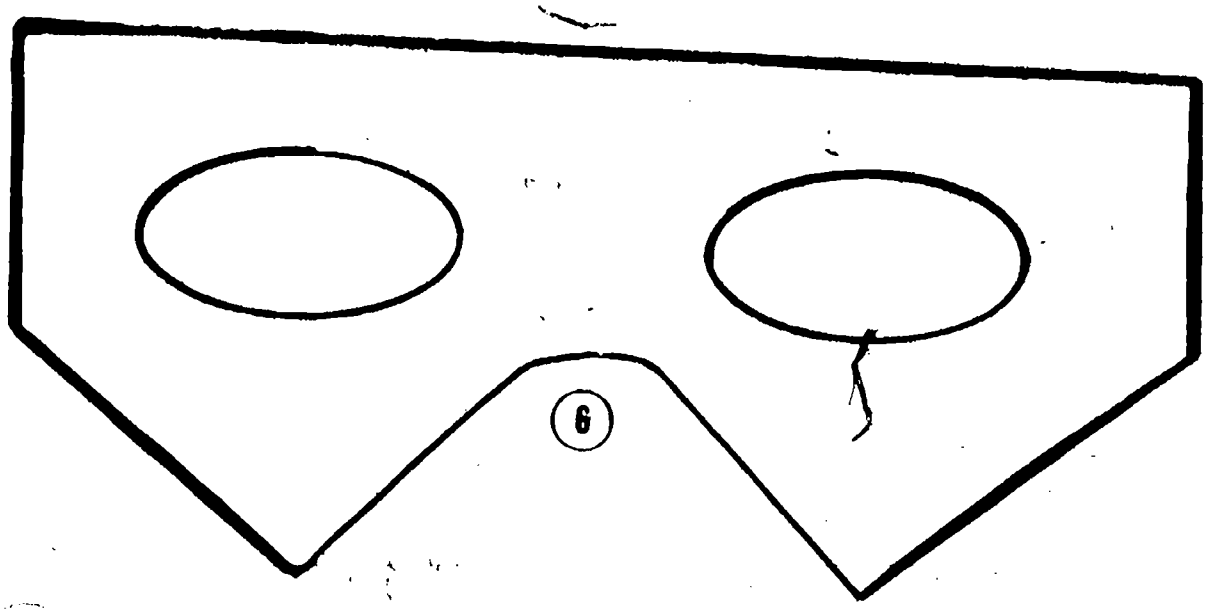
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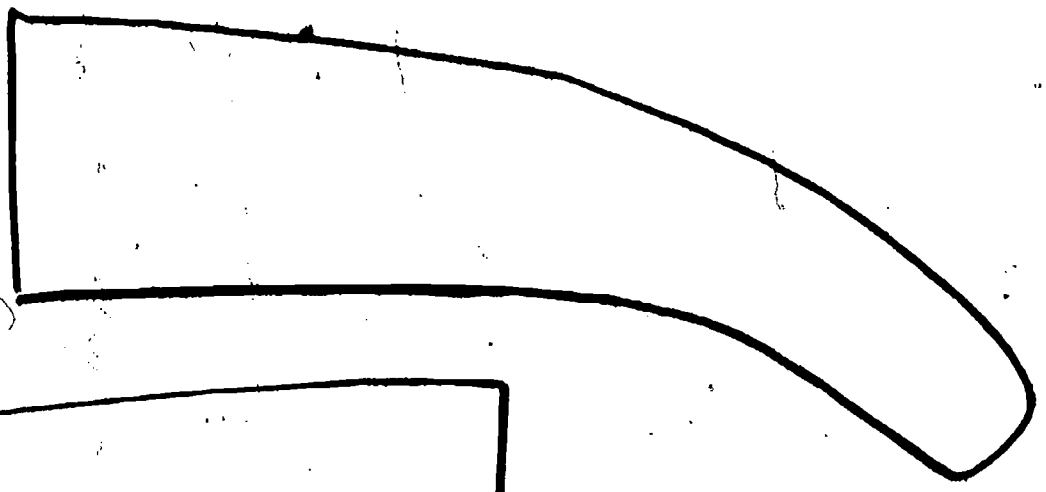

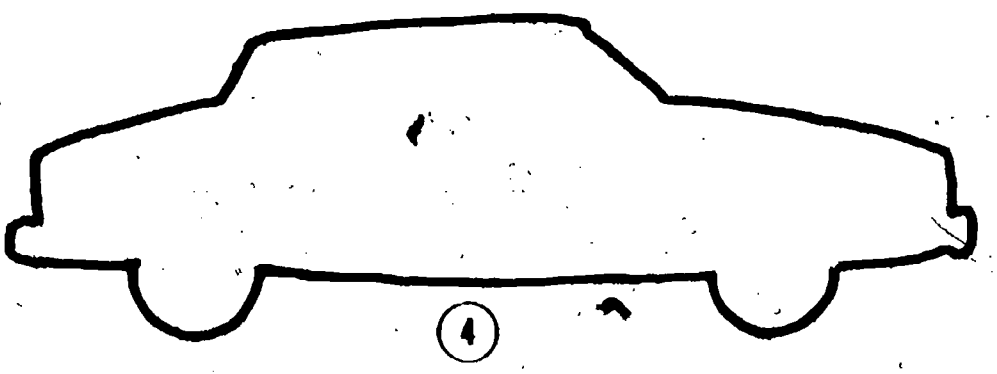
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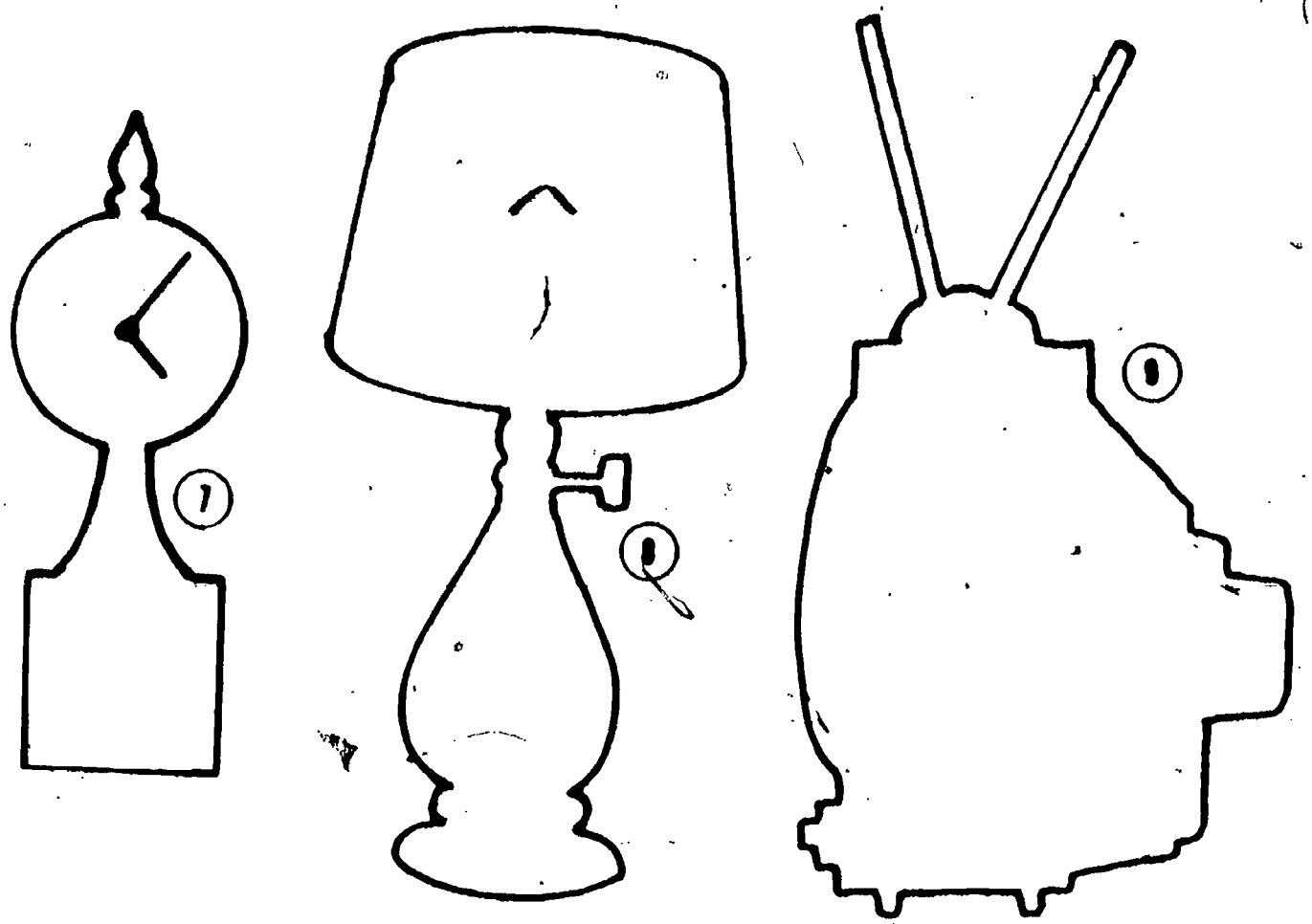

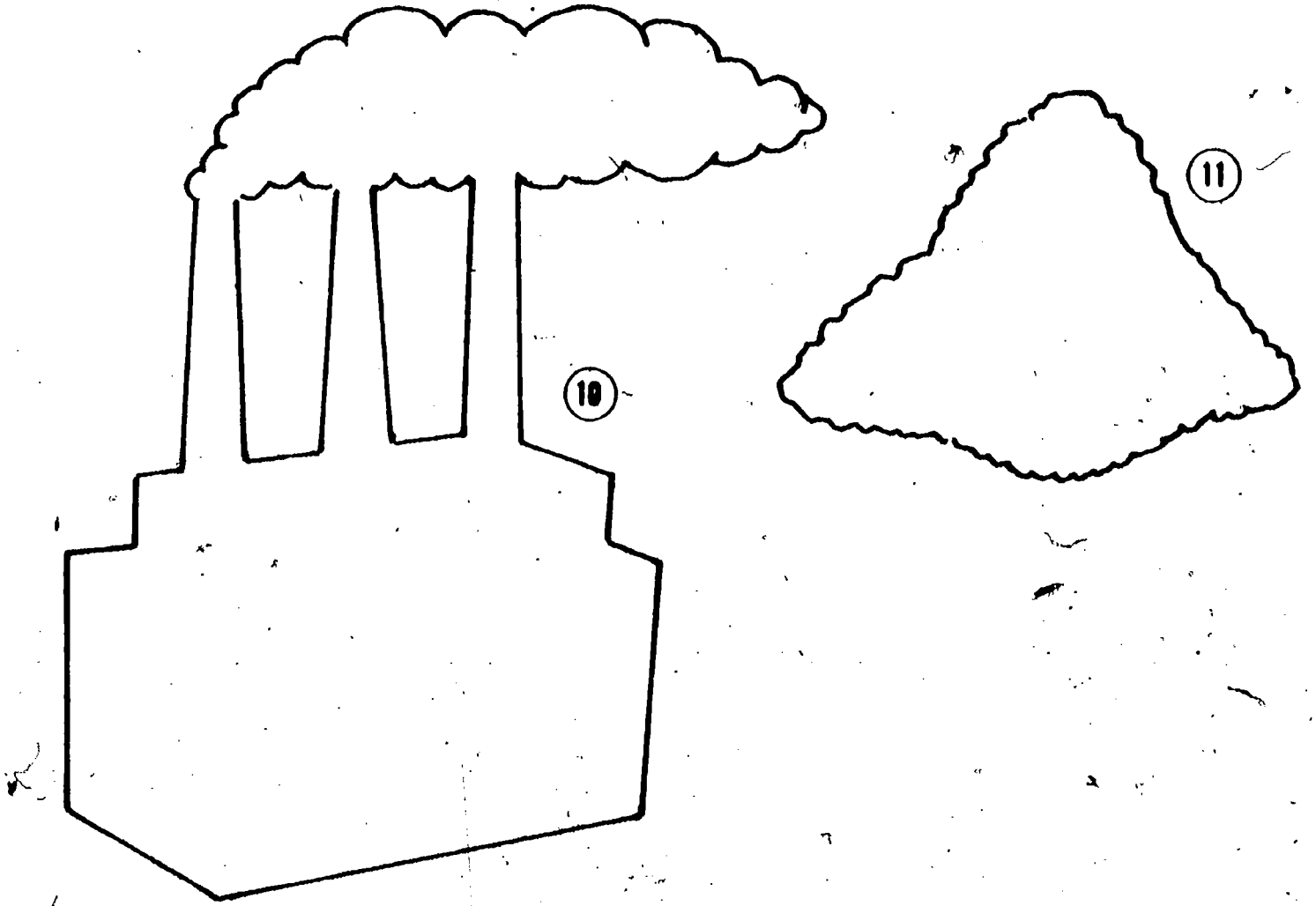

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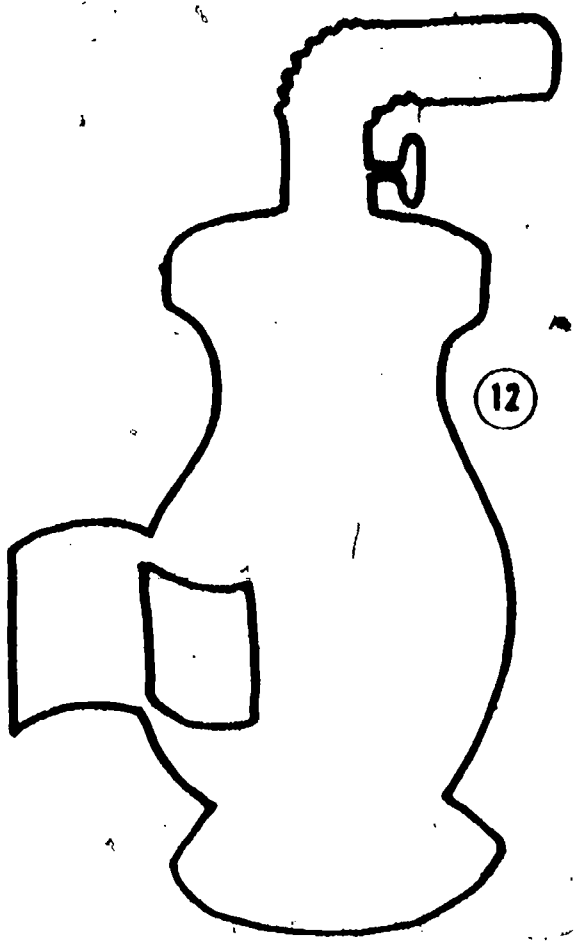
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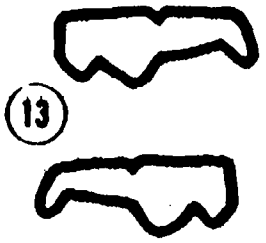
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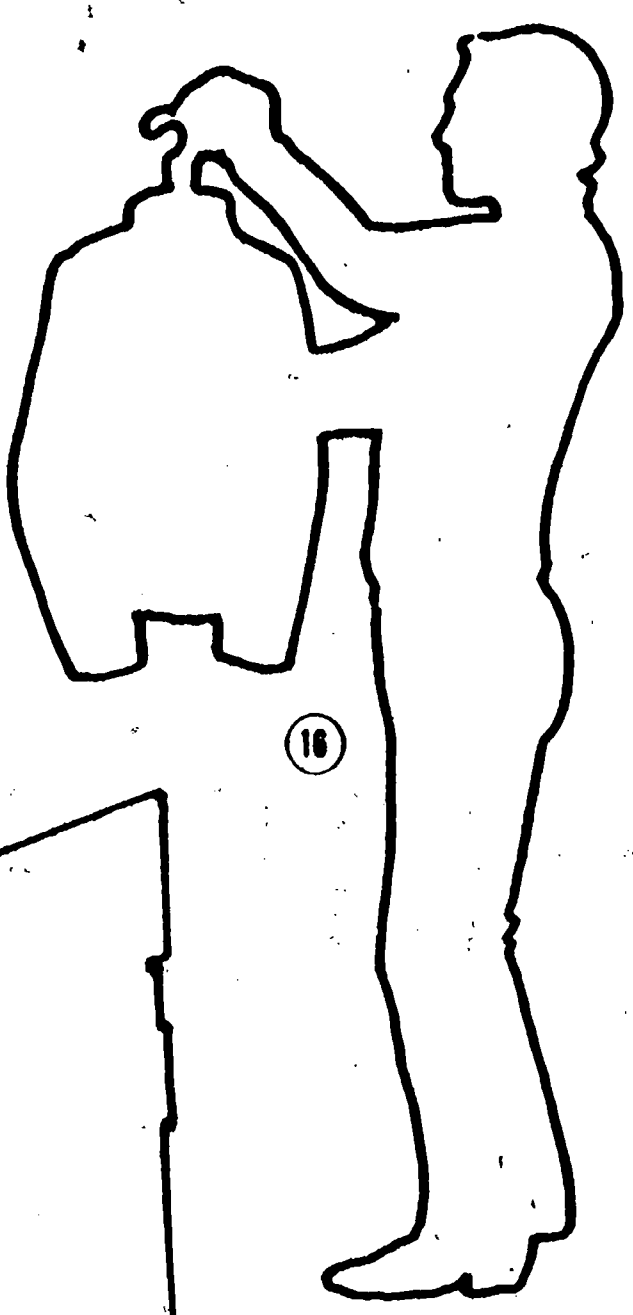
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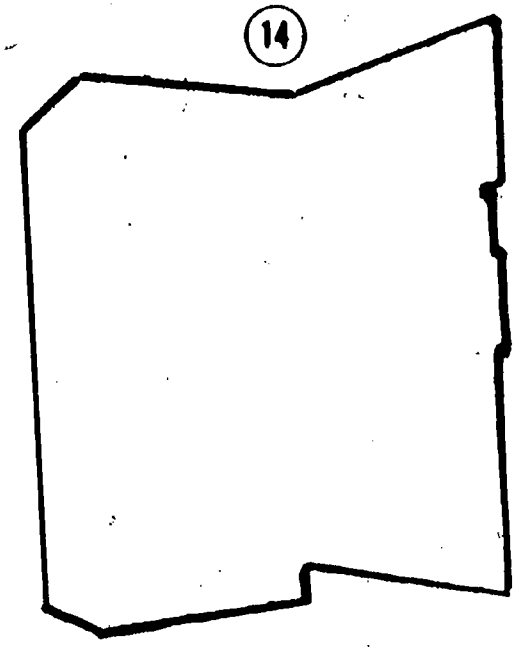
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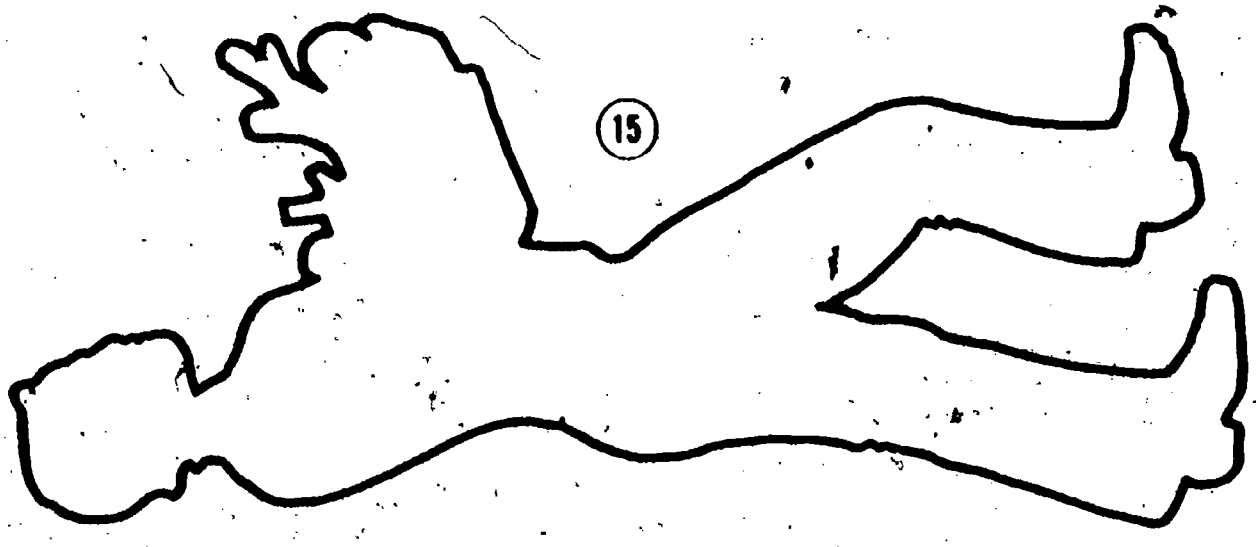
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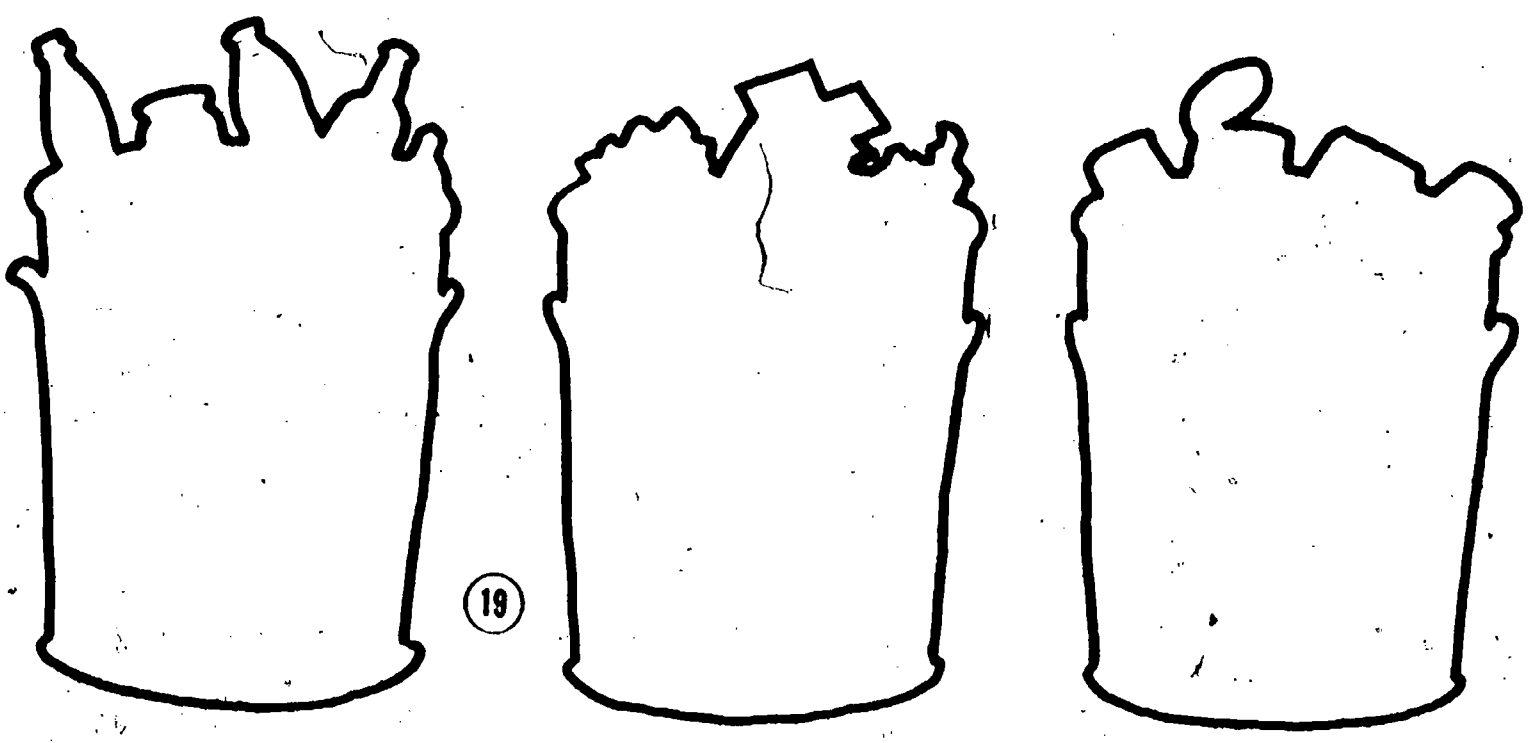
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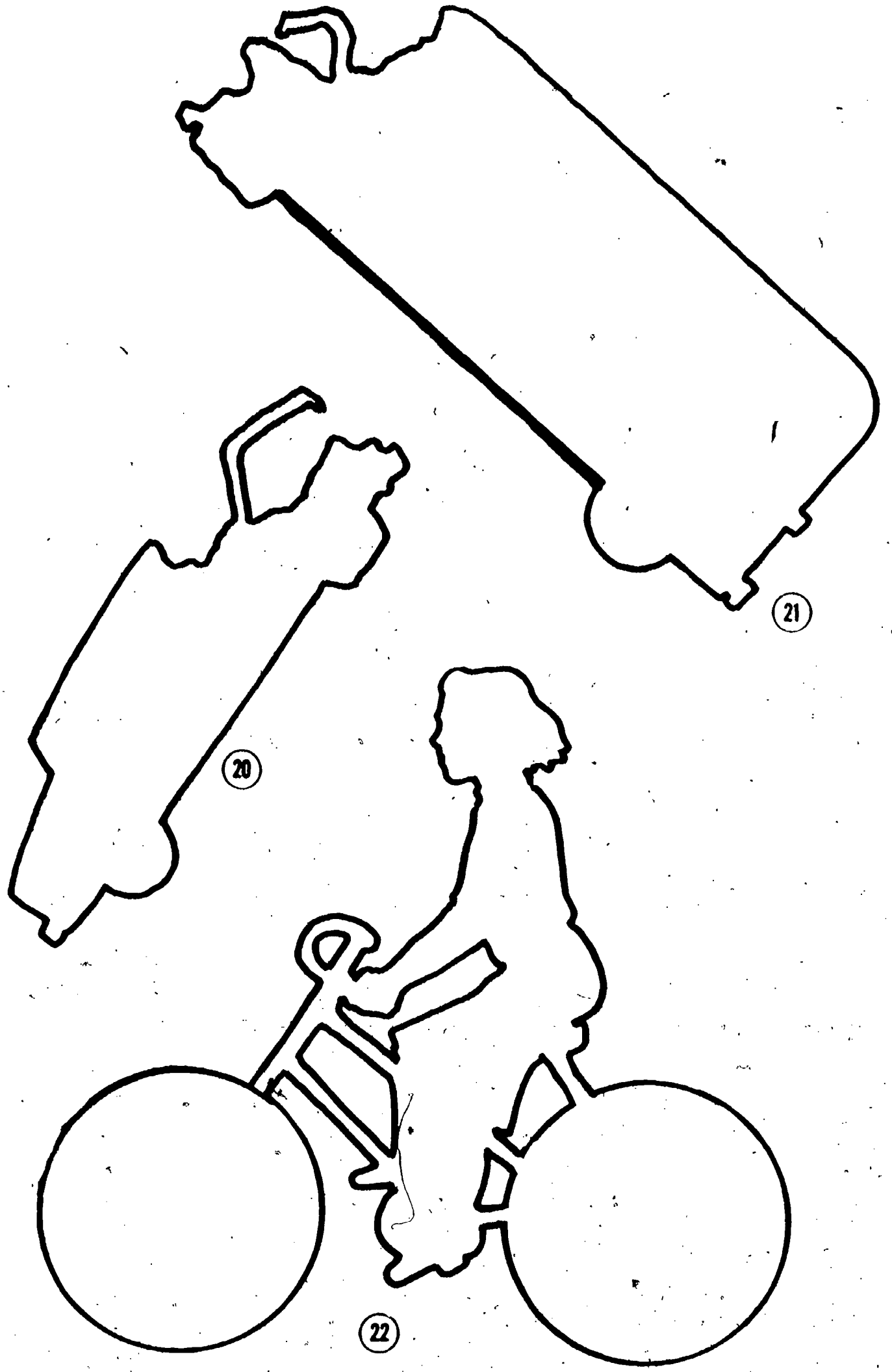
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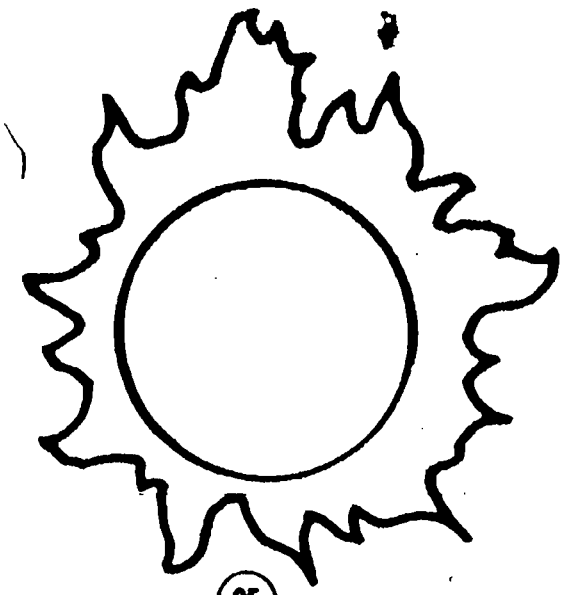

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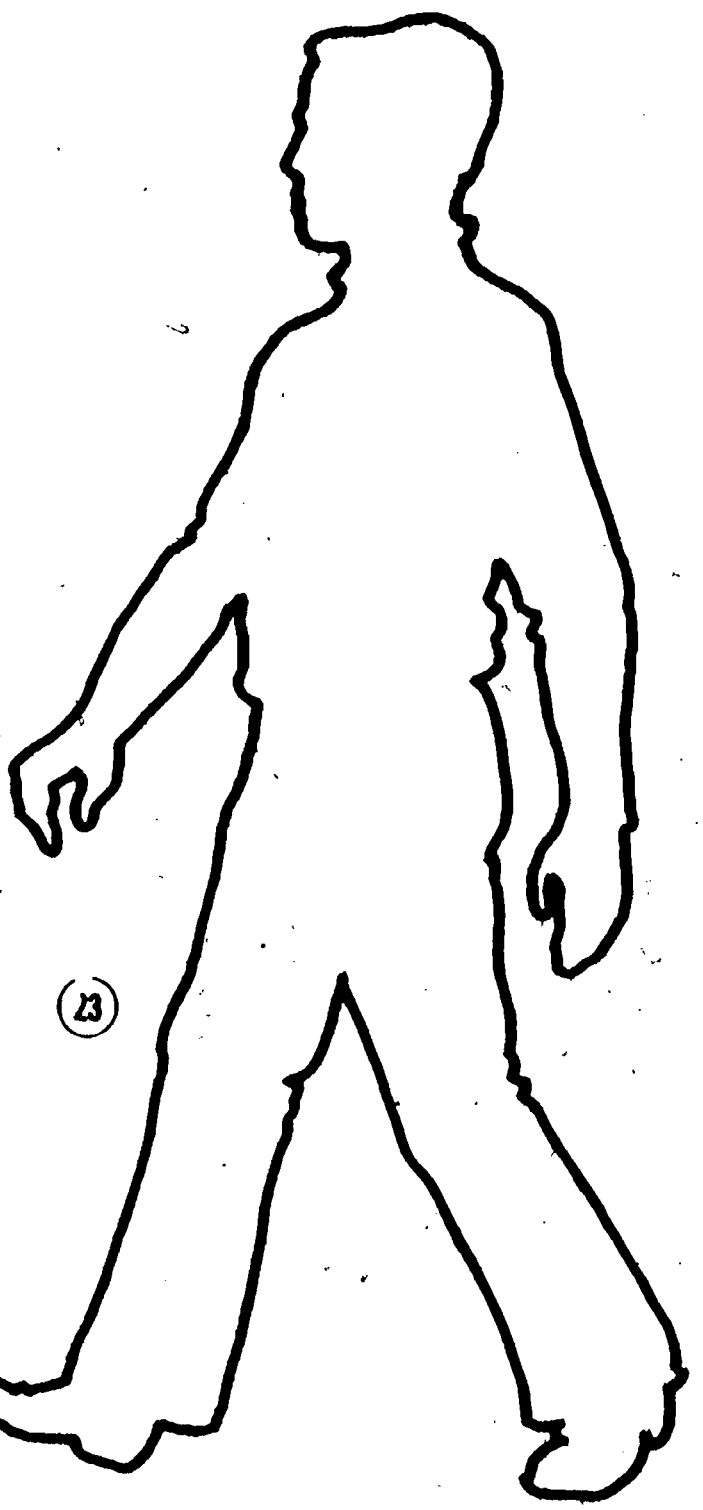

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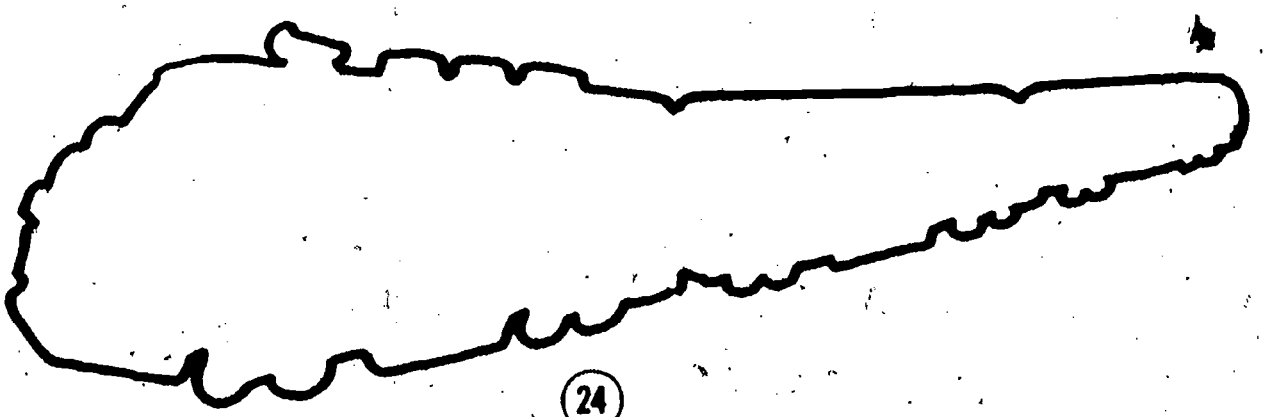

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37

KINDS OF ENERGY WE USE

by Bob Gianettino

ACTIVITY: Kinds of Energy We Use. (Lower elementary)

ACTIVITY DESCRIPTION:

Through a series of activities, students will learn where the energy used at home originates. Activities include speakers, home questionnaires, charts and arranging pictures in sequential order.

ENERGY CONCEPT:

The energy used by a particular family may have its origin in a completely different type of fuel. Such might be the electricity which could have been generated by the use of coal, natural gas, nuclear energy, or hydro power.

OBJECTIVE:

The students will become more aware of energy sources, energy chains, and energy systems. The students will realize that energy may be converted from one form to another before reaching its end use.

CONTENT:

In order to help elementary children understand energy better, it is important that they come to realize that the energy they use may have begun in another form.

MATERIALS:

Home Energy Questionnaire, Tracing an Energy System ditto #1, Tracing an Energy System ditto #2.

VOCABULARY:

system, pipe lines, electric power, electric power lines, furnace, electric generator, natural gas, coal, coal mines, solar energy.

STRATEGY:

1. Send the Home Energy Questionnaire home with the students before this unit is started. Once the questionnaires are returned, compile the information into a large chart or bulletin board for regular review.
2. Invite a representative from the local electric company and the natural gas company, if they are different, to retrace their power supplied to homes to its source. Have the children chart out their own home's lighting or heating energy back to its source after the talk. (You might also like to invite a gasoline station operator or an oil company representative to provide similar information about the gasoline or diesel fuel which is used in each family's cars or the fuel oil used in some of the furnaces.)
3. If possible take a trip to a generating plant or to the power company's headquarters if they have facilities to explain their operation. The Consumers Power Company has such a facility as this on W. Willow in Lansing, Michigan.
4. Teach the word system, if it is a wholly new concept to them, as "a group of related things which work together." Then, using the ditto (Tracing an Energy System ditto #2) have each child cut out the pictures which are part of the system that provides electricity for the lights in his/her home. Once cut out, they should be arranged in the proper order to form the electrical energy system.

______________________School

____
(date)

Dear Parents/Guardians:

Your child's class is about to begin a unit of study on the kinds of fuels (energy) they use in their everyday lives. In order to help all of us to a better understanding of this, we are asking you to complete the questionnaire below and return it to school as soon as possible.

Using the information gathered, we will trace the energy back to its origin.

I appreciate your assistance in this matter.

Sincerely,

____

- -

HOME ENERGY QUESTIONNAIRE

Name ______________________ Date ______________________

What type of energy do you use to supply each of the following in your home?

lights ______________________
kitchen range ______________________
refrigeration ______________________
washer ______________________
dryer ______________________
heat for home ______________________
hot water ______________________
television ______________________
automobile #1 ______________________
automobile #2 ______________________

General Types of Energy

electricity
natural gas
gasoline
diesel fuel
bottled gas
fuel oil
solar energy

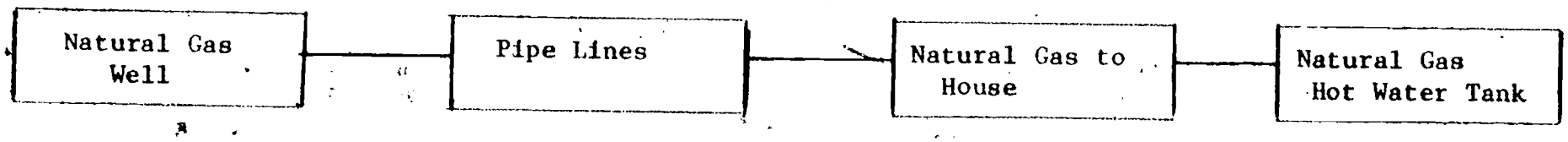
Name _____

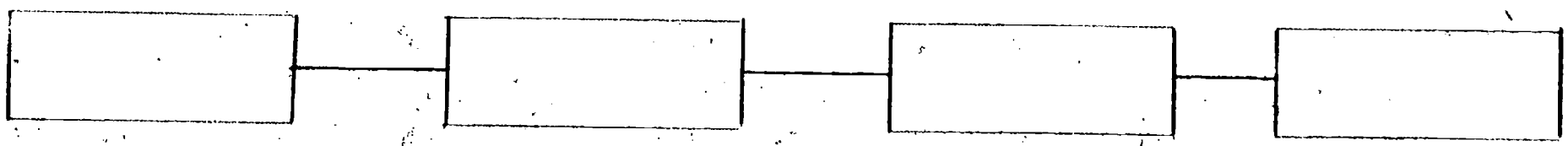
Date _____

Tracing an Energy System #1

Starting from the left hand box, fill in all of the parts of the system of energy and important things which bring the power for lighting or heating to your home.

Example





PARTS OF SYSTEMS YOU MIGHT USE:

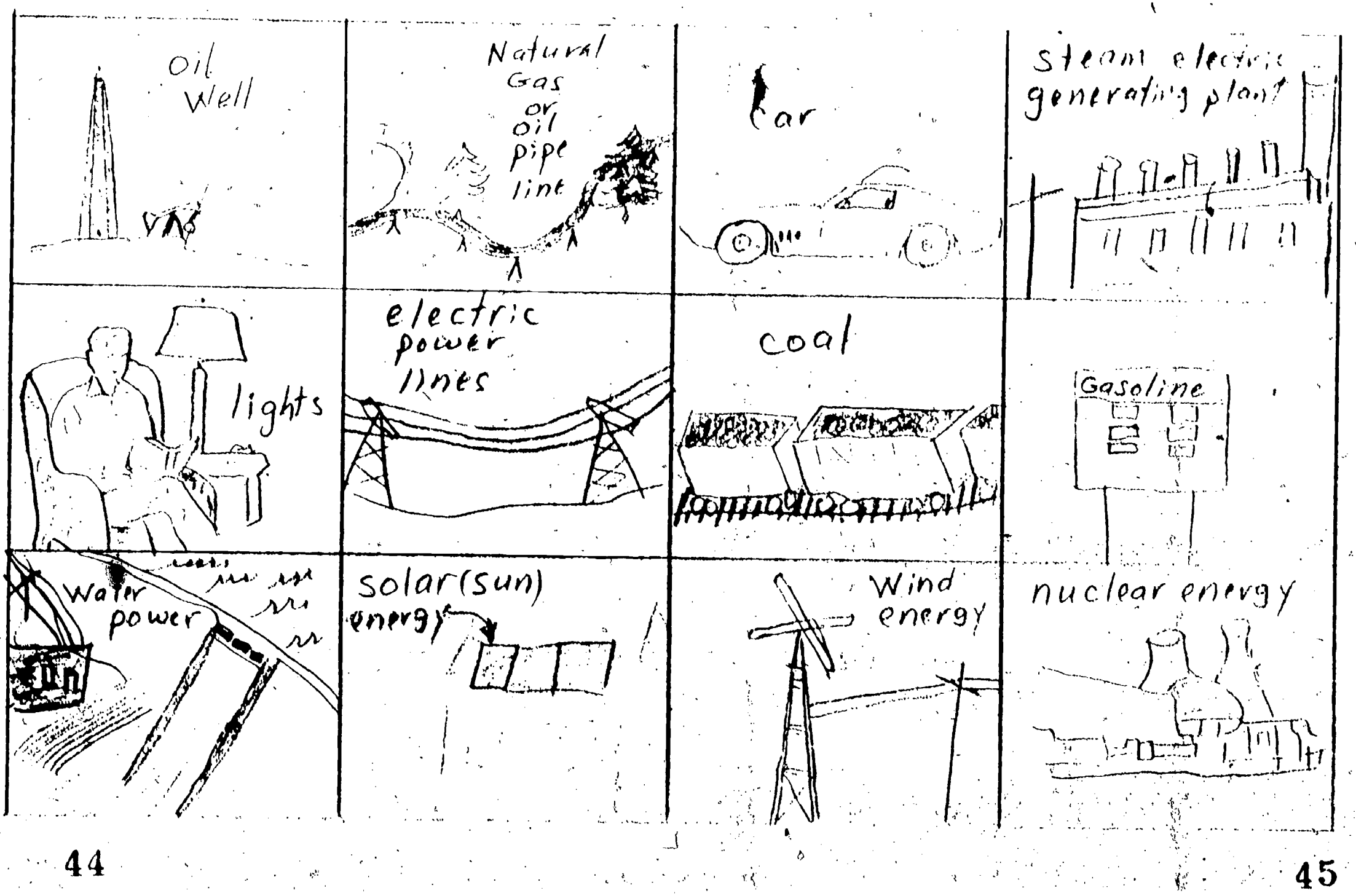
lights
pipe lines
electric lines
heating furnace
electric generator power plant
natural gas well
coal
solar energy collectors
fuel oil
electricity
railroad transportation of coal
coal mine

Name _____

Date _____

Tracing an Energy System

Cut out the pictures below and select from them the ones that help to bring the power to the lights in your home. Then place those that you selected in the correct order.



38. A

DREAMING OF THE FUTURE

by Mona Brandou

ACTIVITY: Dreaming of the Future (Primary, Intermediate)

An Energy Listening Skill Activity

ACTIVITY DESCRIPTION:

Students will listen to story and take active part. Students will discuss how energy is used and how it can be conserved.

ENERGY CONCEPT:

Energy Conservation in Recreation and Leisure Time.

OBJECTIVES:

Students will improve listening skills. Students will be able to list energy consumers and ways to conserve energy.

CONTENT:

The future may be very different for the boys and girls of today. They should be able to look at some things they can do to conserve energy especially in leisure time.

MATERIAL:

Paper and pencil--small groups of students.

VOCABULARY LIST:

energy	limousine	leisure
conserve	future	adult

STRATEGY:

Give students vocabulary list and, if grade 3 or above, have them look up meaning in dictionary. Discuss the meaning and how the word could relate to energy.

Tell students you are going to read them a story and that they will be participating in the story by making sounds. Have students count off into six groups. Give all those in Group one the sound for an electric

blanket (sizzle-sizzle) (or another sound the students may devise).

Group 2

Motor home (rumba-rumba)

Group 3

Motor boat (pudda-pudda)

Group 4

Airplane (nerrr-nerrr)

Group 5

Limousine (beep-beep)

Group 6

Snow mobile (whize-whize)

Then read the story aloud. Each time a word is read that is the "key word" for one of the groups, that group should make its sound. (In other words, whenever the word "motor home" is read in the story, Group 2 should say "rumba-rumba" as quickly as possible.) That way the students must listen carefully to the story for their cues.

After the reading is completed (students may want to do it twice), the teacher should direct a discussion to help the students identify those forms of recreation that consume a lot of energy in contrast with recreation and travel that will not consume as much energy.

After the students discuss some of these activities, they may want to make their own lists of ways to have fun without using much energy. The lists may then be shared and compiled to post in the hallways inviting others in the school to add their ideas for low energy use recreation. Titles could be:

Low Energy Activity Hunt: Can You Add to Our List?

Don't Be Caught by the Energy Crunch: Our Ideas for Free Time Fun Using Less Energy. What Are Your Ideas?

STORY (to be read aloud and accompanied by a fantastic energy sound orchestra).

This Is Not A Fairy Tale

Once upon a time in the year of 1979 there was a young boy who would snuggle down under his electric blanket and dream.

He would dream of the future when he would be all grown up like the adults. He dreamed of owning a big motor home that he would drive on long trips. On the back of his motor home he would hook a big motor boat. He would drive the motor home with the motor boat all over the United States. He would race through the water with his motor boat and spend all day in the sun driving his beautiful big motor boat. When he got bored with his motor home and his motor boat, he would have his own airplane to fly over the country and cities. He would look down at the little houses and people below. He would buzz the peaceful little towns in his airplane and fly over animals in the forest to frighten them so they would run for cover.

If he wanted to travel on a business trip, he would drive his huge limousine. His limousine could go 80 miles an hour and in his limousine he could pass all the other cars on the road.

In the winter when the weather got cold, he loved to take his motor home with his snow mobile and go off for a weekend of racing his snow mobile through the woods. At night he would sleep in his big motor home under his electric blanket and spend the days racing his snow mobile.

So with his motor home, his airplane, his limousine, and snow mobile he lived a busy fast life. He never did have time to make any friends because he traveled so much in his motor home instead of taking a bus with

other people. He didn't learn how to fish because his noisy motor boat scared all the fish away. He didn't learn to swim or snorkle because he was too busy racing from one end of the lake to the other in his motor boat. He never had the joy of sleeping in a tent or under the stars or sitting around a camp fire with friends because he was always in his motor home under the electric blanket.

The boy never did take time to make friends because his airplane kept him so high in the sky all he could see was the tops of their houses. He never had a chance to go inside and have popcorn and talk about when he was young back in 1979.

He never did get a chance to enjoy the beauty of nature because he was always making so much noise with his airplane he frightened all of the wildlife away.

He didn't get the chance to sit on a train and talk with other people about how great it is not to worry about driving your big limousine all of the time.

But one of the saddest things of all was that the boy never learned how to ski and fly like a bird down the slopes in the winter; or to cross-country ski so quietly that the wildlife never runs for cover. He never learned to stop and listen to the birds or see the rabbit tracks in the snow.

There are many kinds of dreams and we must learn to choose with care those that will give us enjoyment as well as conserve our energy.

FOLLOW-UP ACTIVITIES:

1. Have students make lists of activities they can do in leisure time during different seasons of the year.

Low Energy Use Activities

Summer	Fall

Low Energy Use Activities

Winter	Spring

2. Have students cut out pictures from magazines to make a big collage of low energy activities to do in spare time. Make a second collage of pictures that show high energy use and compare the two. Can the students find more pictures of high or low energy activities? (They may easily find more pictures of high energy activities. If this is the case, you may want to discuss the power of advertising on what people buy. Through these ads will they be influenced to use more or save more energy?)

ENERGY CRUNCH

by Mona Brandou

ACTIVITY: Energy Crunch (Grade Level K-5)

ACTIVITY DESCRIPTION:

An art activity for students K-5. The students use imagination to draw the "Energy Crunch"; they then title their work to tell how it uses energy.

ENERGY CONCEPT:

Conserving Energy

OBJECTIVE:

To have students understand that we are experiencing a tightening of energy and to determine some things that my use a lot of energy.

MATERIALS:

Felt pen, tempra paint, paper or poster board

VOCABULARY:

1. crunch 2. "energy crunch" 3. shortages

STRATEGY:

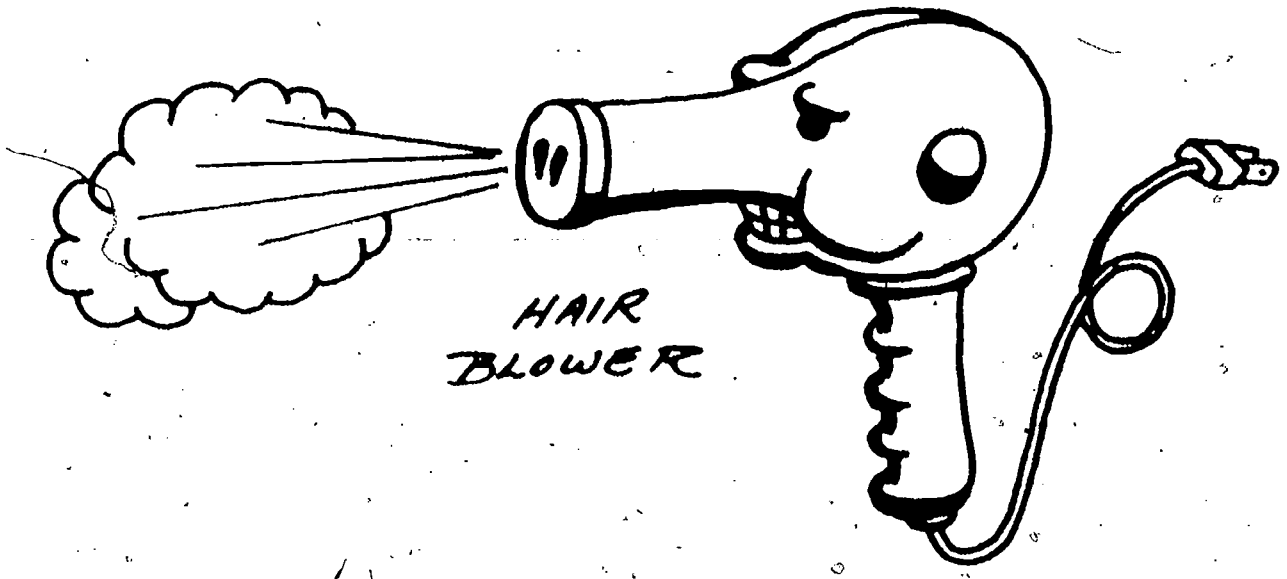
What does the "Energy Crunch" look like? Can you draw a picture of the "Energy Crunch" and tell how it uses energy? Write a verse to go with the "Energy Crunch." When you hear the sound of crunch what do you think of?

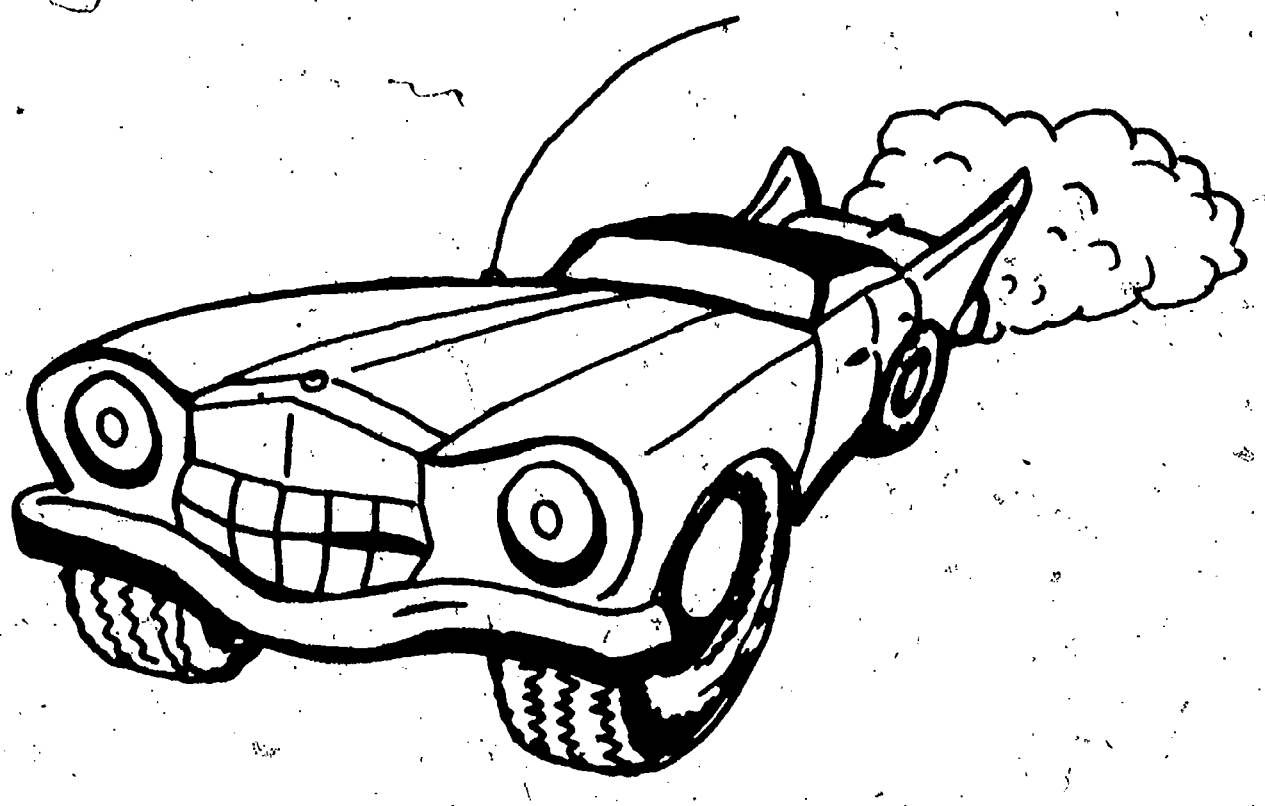
INFUSION IDEAS:

This could be an art activity for all elementary grades. It could be a poster contest with several selected from each class and hung in the library or hall, with the title.

"The Energy Crunch Will Get You if You Don't Watch Out!"

IDEAS FOR ENERGY CRUNCHER'S





EGBERT ENERGY GAME

by Lauma Vilums

ACTIVITY: Egbert Energy Game (Primary, Intermediate)

ACTIVITY DESCRIPTION:

The object of the game is to help Egbert Energy walk from START to his bicycle. The game uses cards that have energy consuming or energy conserving behaviors written on them. For consuming energy, the student must move backwards; for conserving energy, the student moves ahead. In this manner, the students become aware of activities which consume energy versus those which conserve. A poster activity accompanies the game to reinforce awareness of energy conserving behaviors.

ENERGY CONCEPT:

Conservation of energy can be practiced by all of us in many ways in our day to day lives.

OBJECTIVES:

The student will learn to follow directions to a game.

The student will become aware of energy consuming versus energy conserving behaviors.

CONTENT:

The residential sector of society consumes over one-fourth of the total energy used in the U.S. each year. Through awareness activities, students can learn how some of that energy can be conserved at home and at school.

MATERIALS:

Egbert Energy, about 30 colored footprints, about 5 colored footprints with "Save Energy", 1 colored footprint with "You Win!", 1 colored footprint with "START", about 36 cards for directions to move, 1 spinner.

VOCABULARY:

Energy, conservation.

STRATEGY:

1) Energy Egbert Game

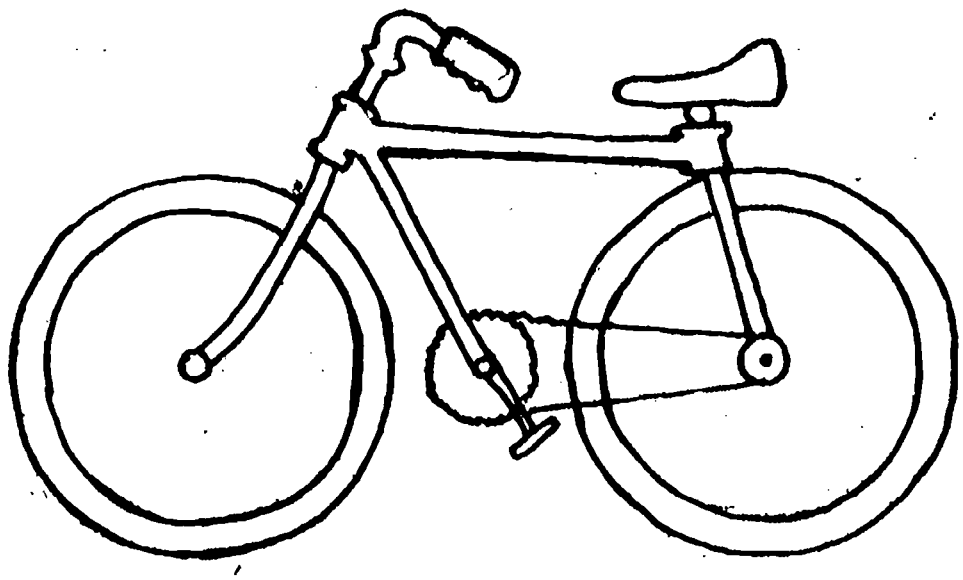
Place the above materials in a gameboard form on a large piece of posterboard. Have a card with the following directions for students on the posterboard:

> "Egbert Energy"needs help walking to his bicycle. First player spins the spinner. Move the number of spaces shown. If you land on a "Save Energy" spot, you do not draw a card. If you land on an empty spot, draw a card, read the back of the card and move as it says. The winner is the first one to get Egbert Energy to his bicycle.

2) Egbert Energy Conservation Checklist: (small group or individual use)

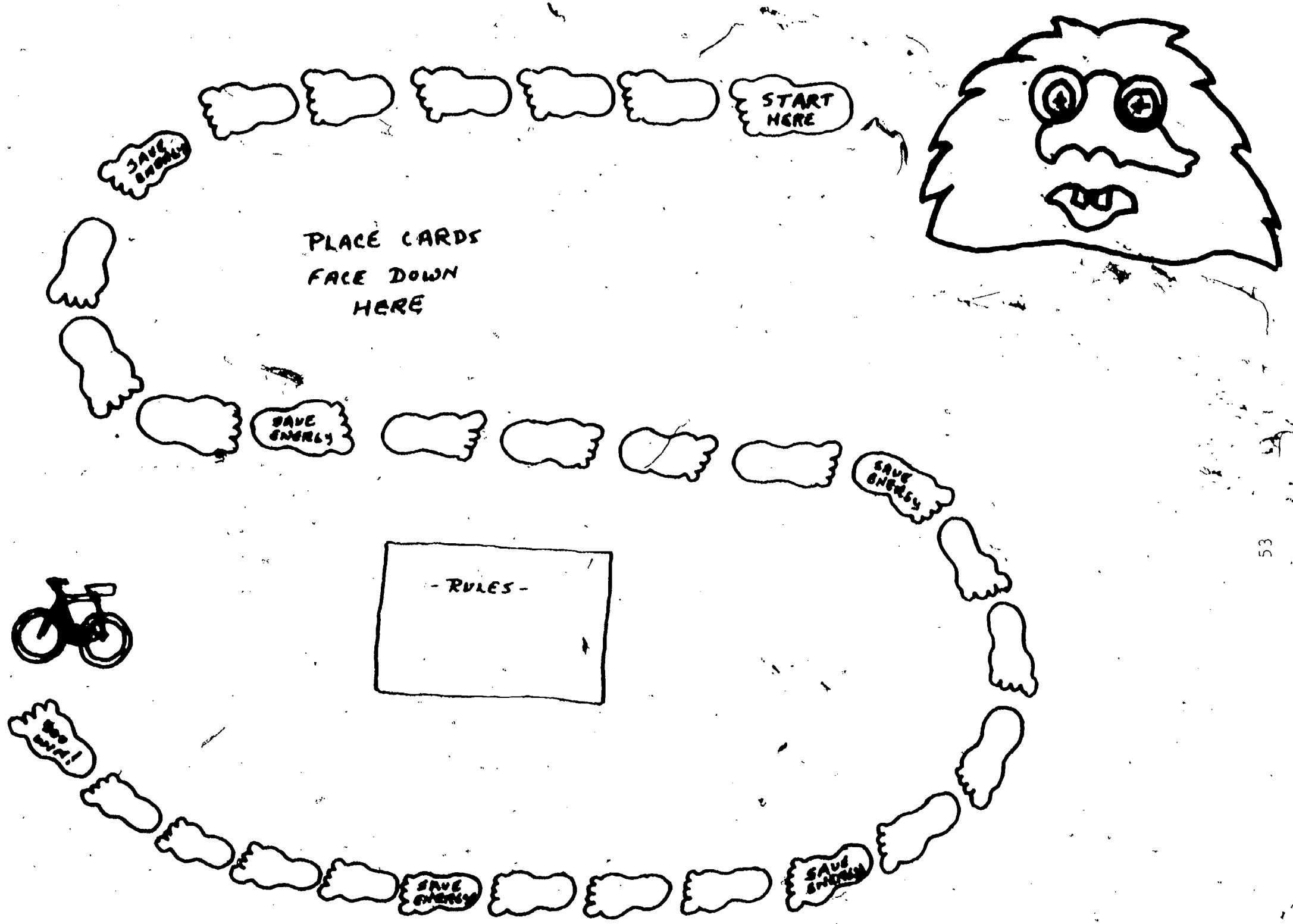
Punch a hole in the top corner for each picture. Student will look at each pair of pictures and choose the activity which conserves energy by placing a pencil through the matching hole. Pictures are self-checking by turning over (while pencil is still in hole) and checking to see if the hole has a red circle around it. (Red circle on back denotes the activity conserves energy.) Pictures may be placed on large sheet of posterboard if desired.

NOTE: Art work for posters will be given out separately.



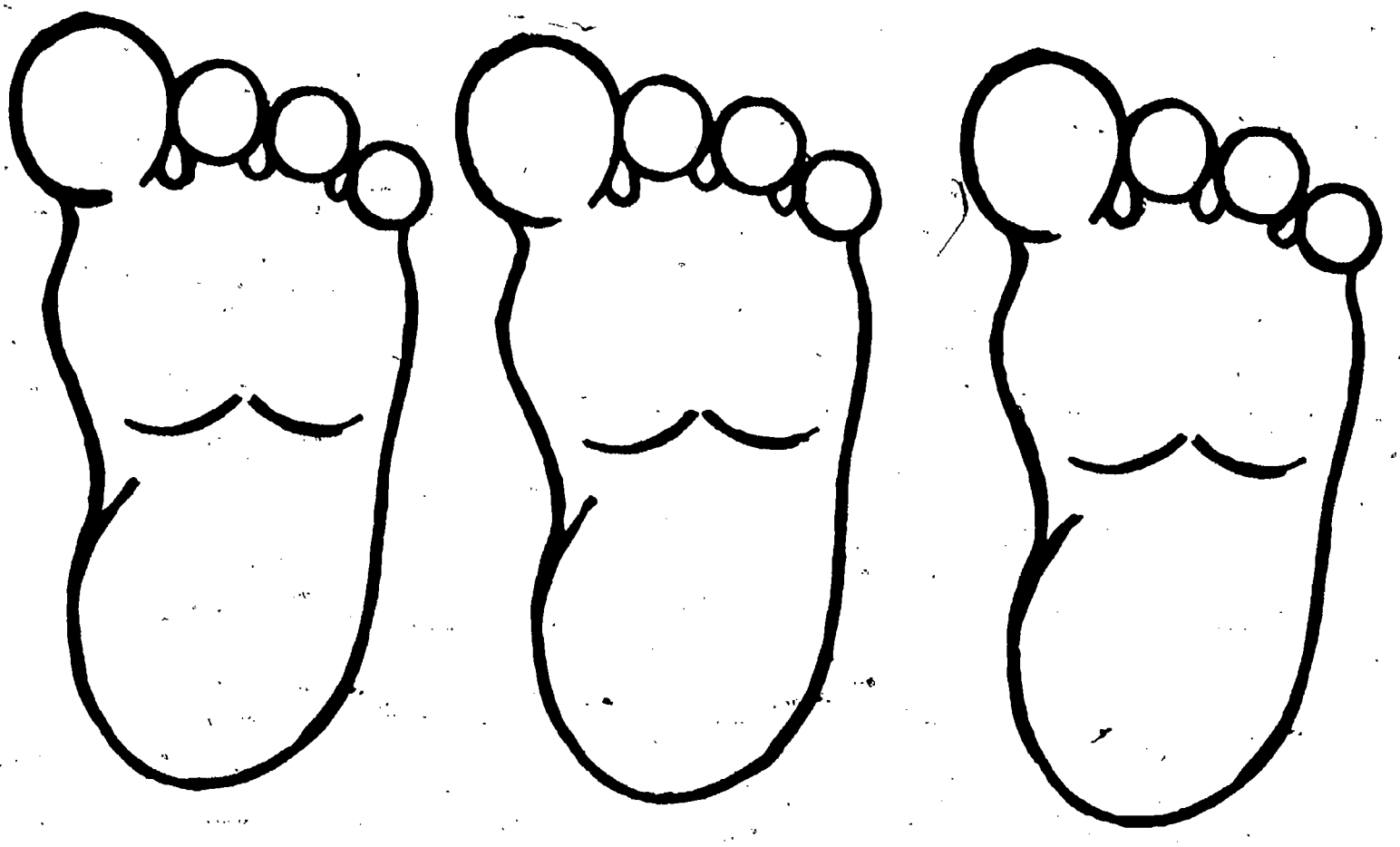
DIRECTIONS - Egbert Energy cares and would like to conserve energy by walking to his bicycle. Can you help him get there?

Spin the spinner. Move the number of spaces. Pick a card when you get to your space unless you land on a "SAVE ENERGY" space.


START HERE
SAVE ENERGY
PLACE CARDS FACE DOWN HERE
SAVE ENERGY
SAVE ENERGY
- RULES -
SAVE ENERGY
SAVE ENERGY

53

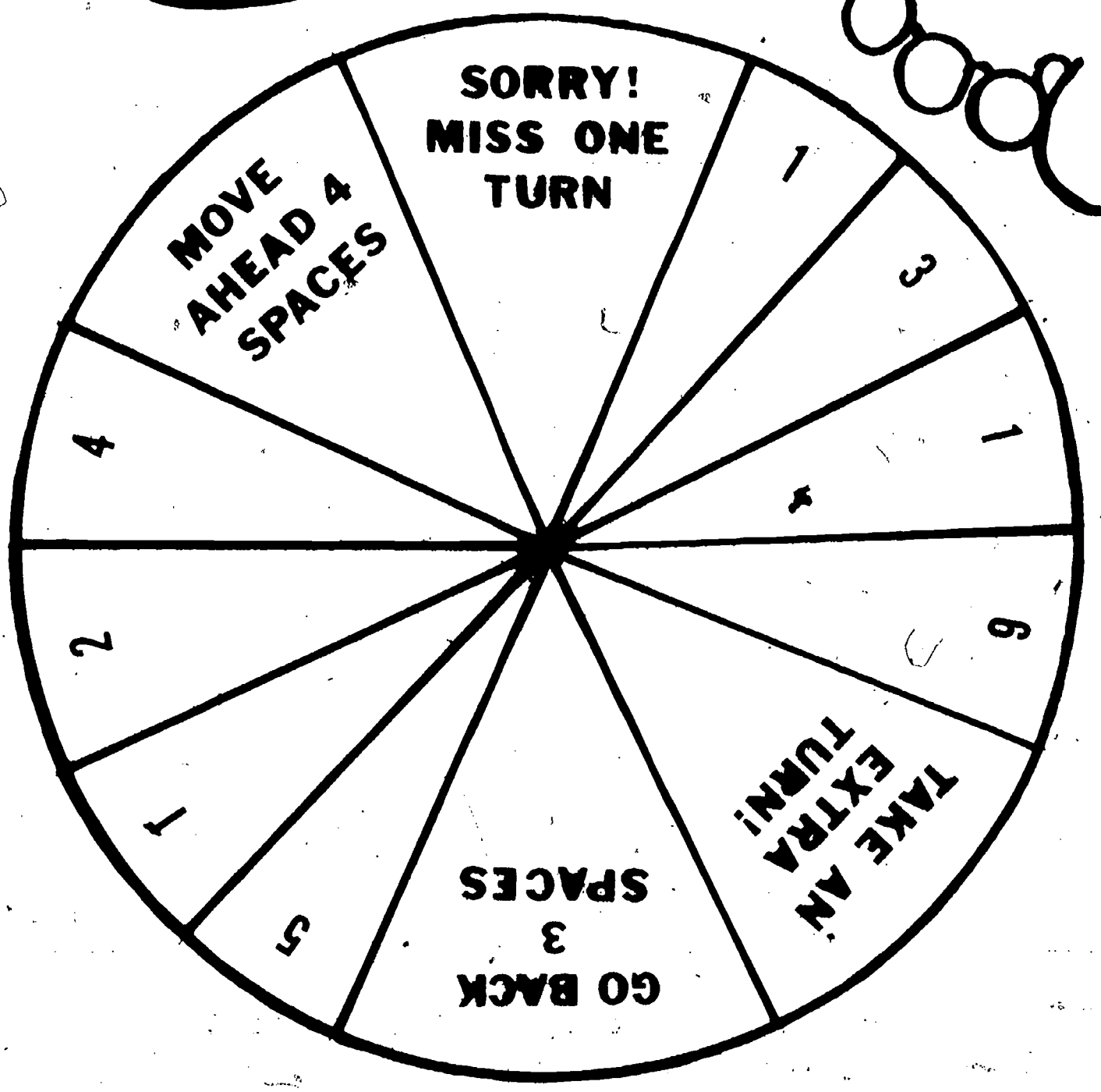

SAVE ENERGY

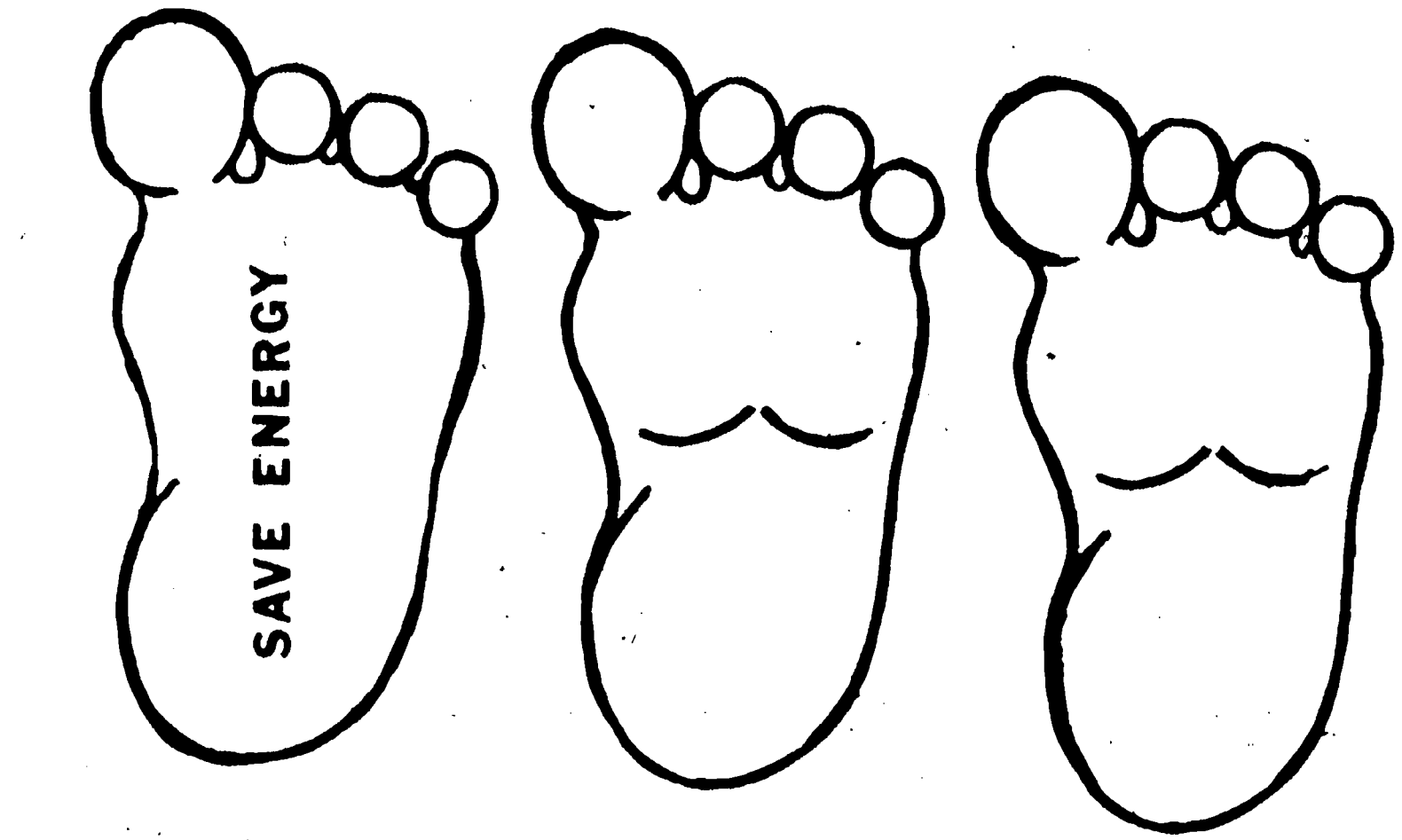


START HERE

SPINNER

YOU WIN!

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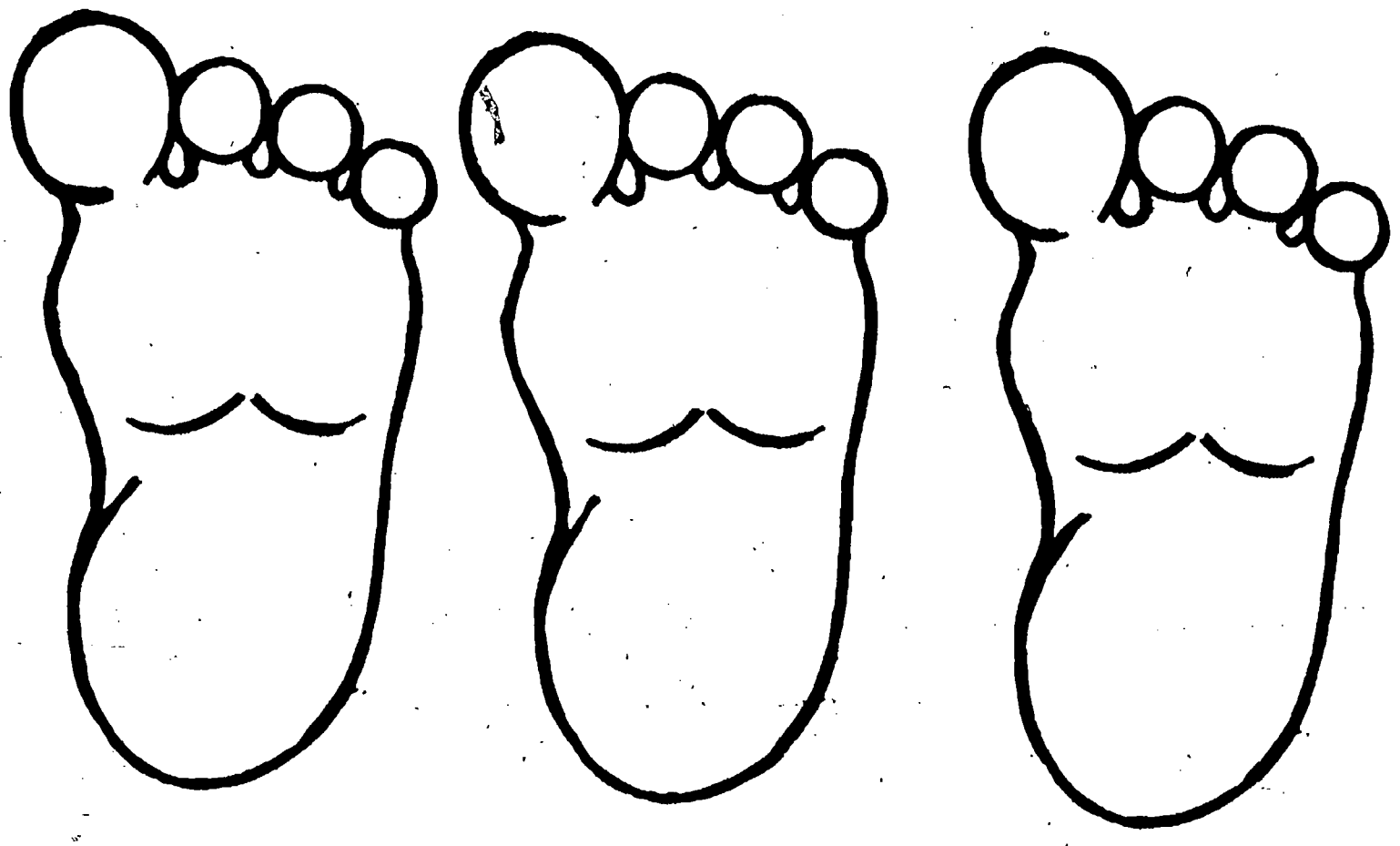

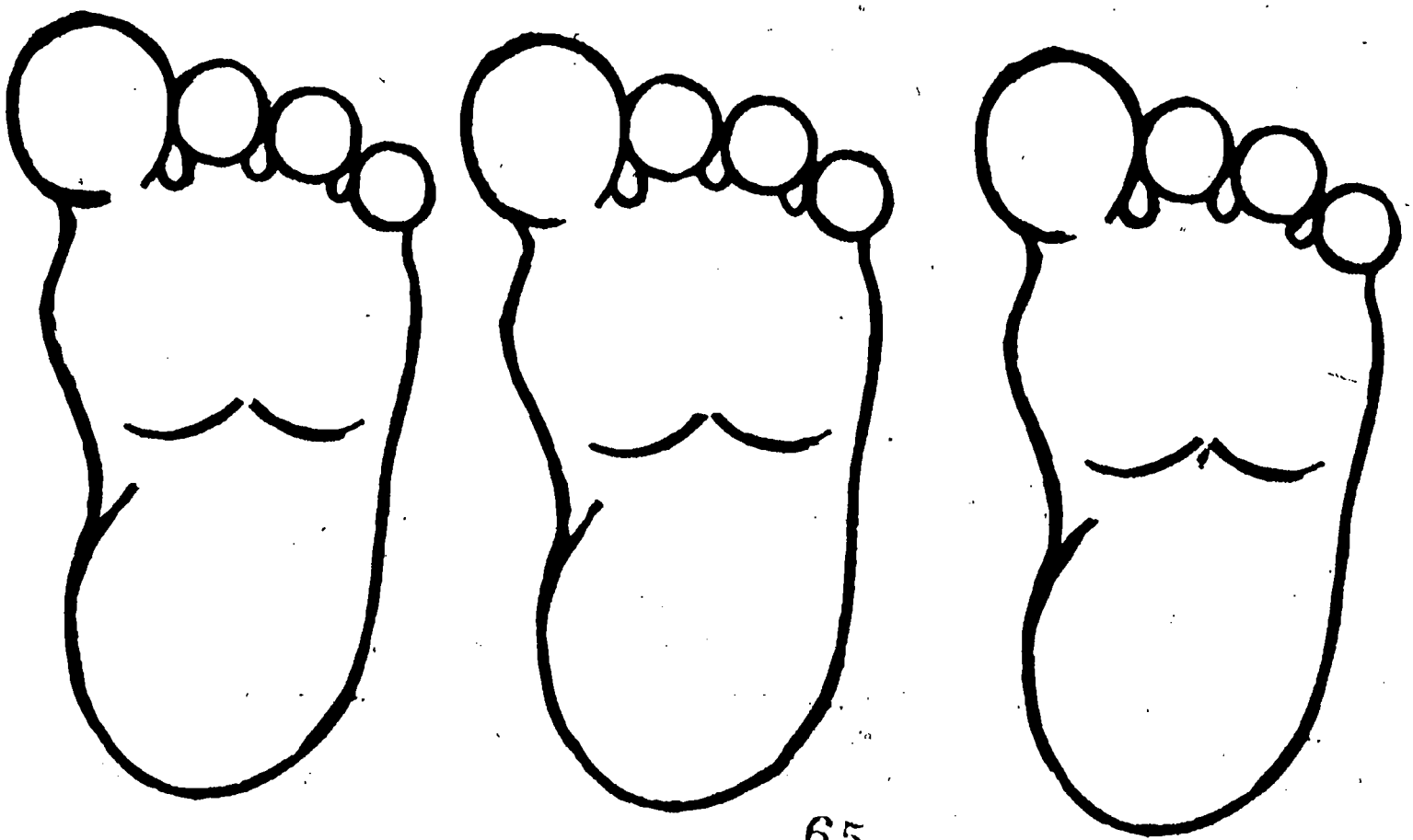

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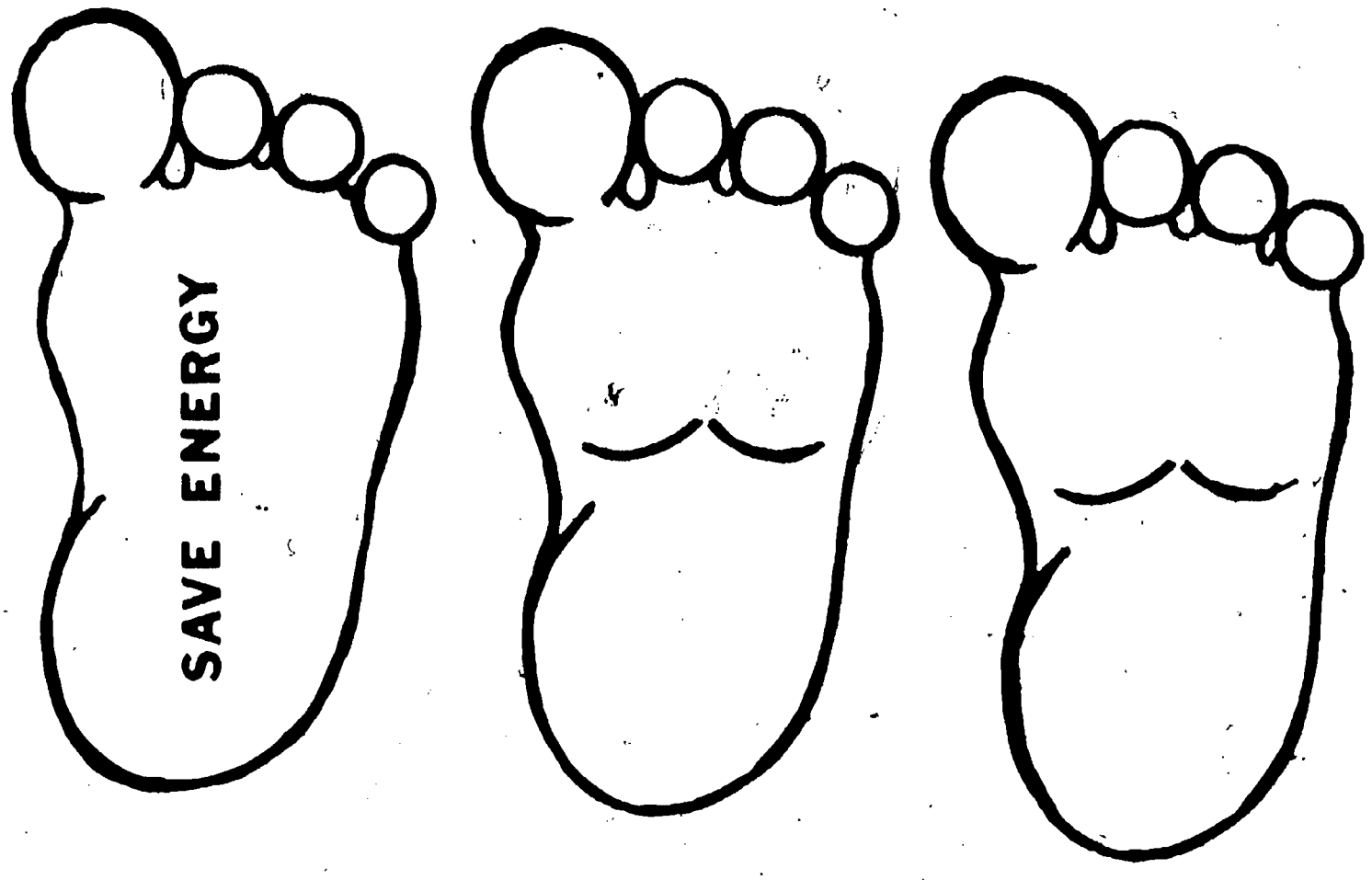
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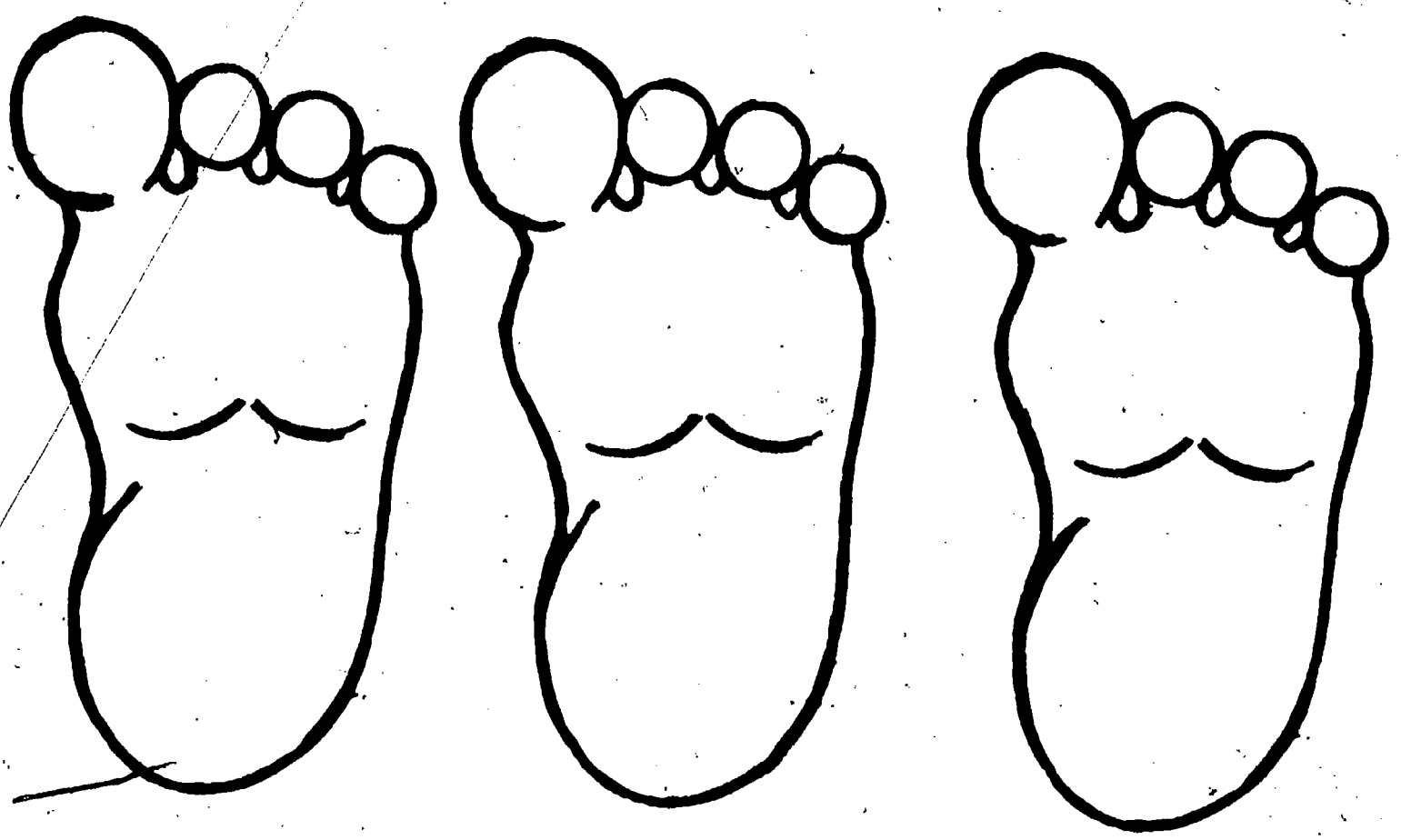
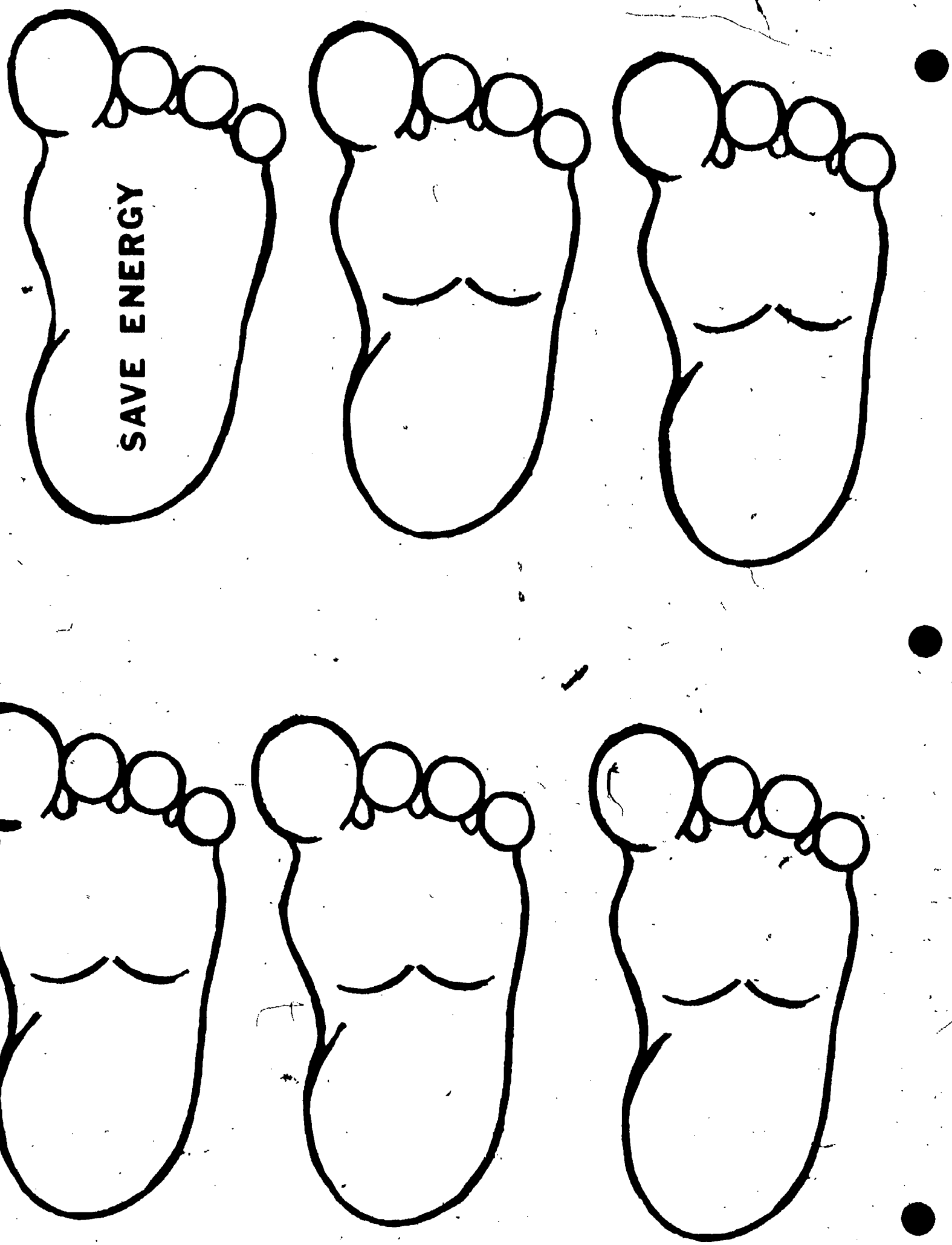



SAVE ENERGY

You shared at home what you learned at school about energy.

Ahead 2 spaces.

You put on a sweater instead of turning on the heat.

Ahead 4 spaces.

You turned the fan on because you were hot.

Back 3 spaces.

You left the T.V. on. Go back 2 steps.

You turned up the heat.

Back 4 spaces.

You used an electric toothbrush instead of brushing by hand.

Back 3 spaces.

The lights in the bathroom were left on.

Back 2 steps.

You left the door open in the cold weather.

Go back 3.

You asked your parents to drive 55 mph to save on gas.

Ahead 3 spaces.

You asked mom to drive you to the store which is just down the street.

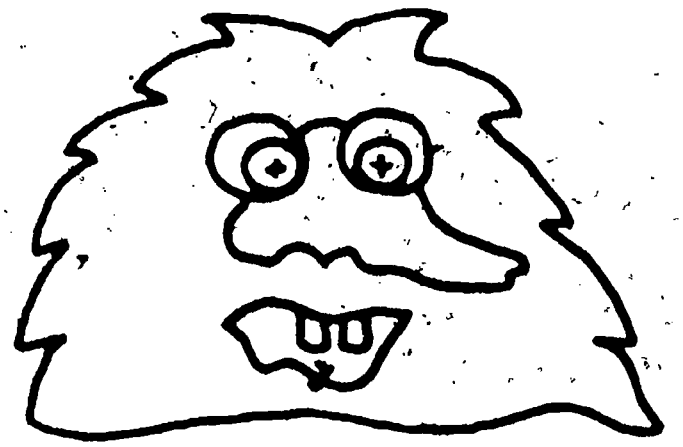
Back 4 steps.

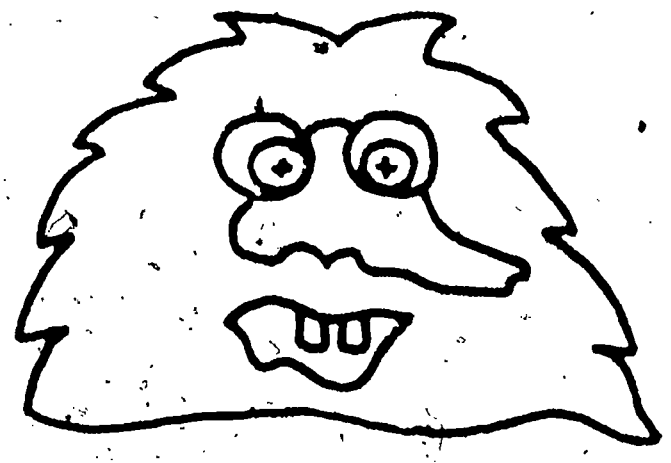
You rode your bike to the store instead of asking mom for a ride.

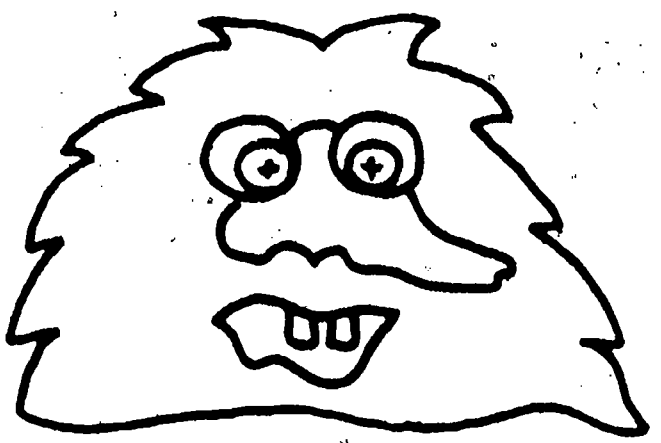
Ahead 4 spaces.

You used a towel to dry your hair instead of a blow dryer.

Ahead 2 spaces.







Your family
tries hard to
help save energy.

Ahead 5 spaces.

Save
Energy!

Ahead 6 spaces.

Your
Family
Cares!

Ahead 5 spaces

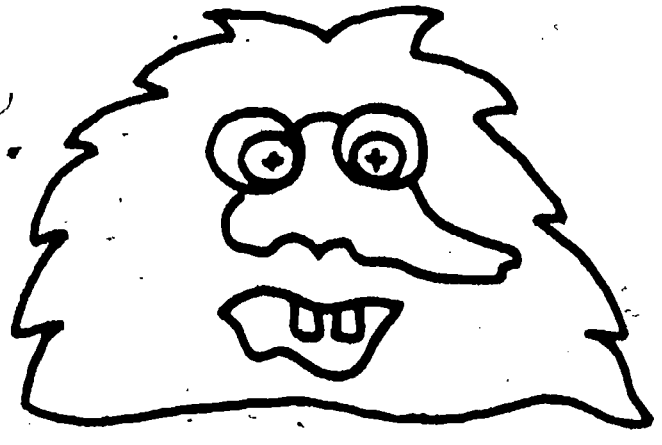
You
Don't
Care.

Back 5 spaces

You turned the
T.V. off when
you were not
watching it.

Ahead 1 space.

73



You wrote a letter to the newspaper telling them you care.

Ahead 3 spaces.

You read a fun book instead of watching T.V.

Ahead 4 spaces.

You left the water running in the sink.

Back 2 spaces.

You think of ways to save energy.

Ahead 5 spaces.

You closed the door tight when it's cold outside.

Ahead 3 spaces.

You left the refrigerator door open.

Back 2 spaces.

75

76

You had the radio on when you were not listening to it.

Back 3 spaces.

Your family rides in carpools.

Ahead 4 spaces.

You Don't Care.

Back 5 spaces

You helped your mother hang up clothes on the clothesline instead of the dryer.

Ahead 4 spaces.

You Care!

Ahead 5 spaces.

You Care!

Ahead 5 spaces

77

KILL-A-WATT ENERGY SAVING CALENDAR FOR 1980

by Sue Sherrington

ACTIVITY: Kill-A-Watt Energy Saving Calendar for 1980 (Grade level K-12)

ACTIVITY DESCRIPTION:

The Energy Saving Calendar for 1980 can be an important addition to a classroom. The Calendar is designed to promote awareness. It can make us all the more conscious of what we can do in our daily lives to conserve energy.

ENERGY CONCEPT:

Conservation

OBJECTIVES:

Students will

- understand what energy is.
- understand the various forms of energy.
- know the difference between renewable and nonrenewable energy.
- see the importance of energy in their lives.
- become aware of the importance of energy conservation.
- learn some of the things that they can do to conserve energy.
- become familiar with the Energy Conservation Ethic.
- promote energy conservation at home.

CONTENT:

Uses of energy in day-by-day living and how we can conserve it.

MATERIALS:

Energy Saving Calendar

VOCABULARY:

Define new words as introduced on the Calendar.

STRATEGY:

The Calendar can be used by individual children or by a whole class. Individuals can explore the various ideas proposed. A child will need to do additional research when working on his/her own, and the Calendar gives suggestions for things to look into, things to experiment with and ways for that child to conserve energy and promote conservation at home.

In the classroom, the Calendar can serve as a starting point for introducing various ideas each month. The topic presented on the Calendar

can be the subject of discussion, research, and experiments. It should be understood that the Calendar is not meant to be the whole energy curriculum; but will serve as a starting point. The class could start each month looking at and talking about ideas from the Calendar and then branch out from there, following up on questions asked by the Calendar or their own questions generated by discussions. The child's research, done either individually or in small groups, should culminate in presentations for the class. The presentations could take the form of reports, dioramas, models, plays, stories, advertisements, posters or other. Throughout the study, children should be encouraged to practice the conservation methods suggested by the Calendar and found in research, and promote their use at home.

NOTE: The teacher may want to rearrange the Calendar pages to make it a school year calendar, starting with September and ending in June with suggested summer activities.

On the following pages, you will find a sample month from the Kill-a-Watt Energy Saving Calendar. (The author did not wish to have the entire calendar reproduced.) You may want to develop the remainder of the calendar as a class project using a different energy saving theme each month, such as: home heating and cooling, transportation, appliances, recreation, energy conservation ethic, meter reading, energy and food, energy and occupations, energy used at school or other topics the students suggest. Each month should concentrate on conservation of energy in different aspects of daily life.

Telephone your local recycling center to find out what resources (your household throw aways) you can recycle and how to prepare them for the center.

Can you make one shopping trip to the grocery store without buying any items packaged in non-reusable plastic?

TRASH

For one week collect and separate the following household wastes. These items should be washed when necessary and stored in plastic or brown paper bags (since these containers are light weight.) At the end of the 7 days, weigh each bag, then total the column. The total figure multiplied by 52 is the approximate weight of your household waste per year.

	Weight
Scrap Food	
Plastic Items	
Waste Paper	
Glass	
Metal (cans, aluminum trays)	
Total	
	x 52
Approximate waste/year	

81

SEPTEMBER 1980

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Odometer Meter 1	2	64 million tons of paper were produced in 1972 in U.S. 17 trees are required to make one ton of paper. 3	4	5	6
Don't throw products into the trash heap when they still have a useful life. Call the Salvation Army or Good Will Industries. Have a garage sale. 7	8	9	10	Is it inexpensive, yet efficient, in terms of cost? 11	12	13
14	How Long will it last? 15	16	Throwing away one beverage bottle wastes as much energy as a 100 watt bulb uses in 4 hours. 17	18	19	12% of the nation's trucks are engaged in waste disposal. 20
21	Since the average American produces 3.2 lbs. of trash every day, we must recycle or see our quality of life buried by that trash. 22	23	24	25	26	27
Can it be recycled? 28	29	Odometer Meter 30				

ENERGY OCCUPATIONS

by Nancy Landes

ACTIVITY: Energy Occupations (Grades K-adult)

ACTIVITY DESCRIPTION:

This activity is designed to encourage communication between students while becoming aware of the relationship between jobs and energy use.

ENERGY CONCEPT:

People use energy at work.

OBJECTIVES:

The student will communicate with fellow classmates. The student will develop an awareness of energy usage in jobs.

CONTENT:

All jobs require energy, some more than others. Some occupations require obvious energy use (such as that of a truck driver or airplane pilot), but even doctors, lawyers, and ministers require energy to do their jobs even though this energy use may be more subtle.

MATERIALS:

Occupation cards (index card with one occupation written on one side).

Straight pins or masking tape.

VOCABULARY:

All occupations listed below could be used as vocabulary, also:

occupation

energy use

STRATEGY:

1) Make occupation cards. (Print each occupation on a 3 x 5 index card).

2) Pin an occupation card on the back of each student's shirt without letting the student see what occupation is printed on his/her card.

3) Instruct the students, as follows:

a) "Each of you has become a working person. Your job is printed on the card pinned to your back. The object of this lesson is for you to find out what your job is by asking questions of others in the class.

b) You may ask <u>only</u> questions that can be answered by "yes" or "no". You may <u>not</u> ask, "Do I work outdoors or indoors?" but you may ask, "Do I work outdoors?" Then if the person answers "No," you may assume you work indoors. You should try to narrow down the possibilities before you begin asking, "Am I a doctor?" or "Am I an elephant trainer?", etc.

c) You may only ask <u>3</u> questions of each person you talk to and they may ask you only 3 questions. Then you are to find a new partner and ask 3 more questions. You continue asking people questions, 3 at a time, until you guess your occupation.

d) When you have guessed your occupation, you may have someone remove your card and then help answer other people's questions."

4) Begin the lesson. You will probably need to help students phrase their questions properly (depending upon age of students) and be sure they keep moving from one person to the next in asking and answering questions.

5) End the lesson when most students have guessed their occupation.

LIST OF OCCUPATIONS:

This list is by no means all inclusive. You may need to add or delete certain occupations as you make the occupation cards.

Farmer	Trucker	Retail Store Owner
Service Station Owner	Resort Owner	Marina Owner
Banker	Insurance Salesman	Lawyer
Fireman	Garbage Man	Student
Doctor	Dentist	Lumber Man
Road Builder	Bike Shop Owner	Movie Owner
Fast Food Store Owner	Real Estate Salesman	Boat Operator
Airplane Pilot	Engineer (Train)	Engineer, Mechanical, Civil, Chemical
Labor Leader	Senator	Auto Worker
Plumber	Electrician	Carpenter
Home Builder	Pharmacist	Scientist
Hospital Administrator	Nurse	Newspaper Reporter
Radio or TV News Reporter	Professional Baseball Player	Used Car Salesman
Truck Driver		

FOLLOW-UP ACTIVITIES:

1) Discuss energy used in the occupations they found on their cards. Which use a lot of energy? Which don't use very much energy? You may want the students to group themselves into "High Energy Users" and "Low Energy Users."

2) Discuss their parents' jobs and use of energy on those jobs. Which jobs will be more seriously affected by the energy crisis? Have any parents had to modify or completely change their jobs because of energy problems?

3) Find out what grandparents or great-grandparents have done for a living. Compare energy used then to now. (Don't forget housework as an occupation for discussion.)

ENERGY INPUT IN PRODUCT MANUFACTURING

by Karen Grover

ACTIVITY: Energy Input in Product Manufacturing (Third grade or above)

ACTIVITY DESCRIPTION:

Students will insert energy symbols where it is being used to produce consumer goods.

Students will indicate where energy was needed to produce other types of energy.

Students will indicate possible sources for the energy inserted for goods production.

ENERGY CONCEPT:

Consumer goods represent used energy.

OBJECTIVE:

Upon completion of this activity, each student will be able to describe at least one way energy is used to produce consumer goods.

CONTENT:

Producing consumer goods costs energy of varying kinds and amounts. What we buy effects the demand for more energy use.

MATERIALS:

From Farm to Restaurant poster set and the energy symbols for the poster set. (Eight posters and energy symbols for coal, electricity, solar, oil or gas, and human energy.)

VOCABULARY:

Goods, Consumer, Transportation, Producer, Production.

SUBJECT INTEGRATION:

This attivity could be used in conjunction with units of these subject areas: Social Studies, Nutrition, and Career Education.

STRATEGY:

Develop the meanings of consumer, producer, and goods. Do you buy things? (Candy, food, etc.) Do you use things? (Bike, toys, etc.) If you do either of these you are a consumer.

Do you make things? (Cakes, cookies, etc.) Have you ever put something together? (Models, toys, etc.) If you have done either of these you are a producer.

What have you purchased? (Model airplane, doll, etc.) What have you made? (Pie, model car, etc.) These are called goods.

Set up charts and symbols. Explain that they will be seeing how items for making a pizza are produced. Tell them to be watching for all the ways energy is being used in each picture. The following set of questions are suggested for use with each picture and could be placed on the back of the posters.

Dairy and Beef Farm

1. What is happening in this picture? (Cows are eating grass, cows are eating corn stalks. Trucks are taking animals away. The milk truck is taking the milk, etc.)

2. Where is energy being used? (The truck is using it. The cows are being milked in the barn, etc.)

3. What kind of energy is used by the trucks?

4. Are there any other kinds of energy being used? (Solar may have to be pointed out since the grass is using it.)

Crop Farm

1. What is going on in this farm? (Things are being grown, planted, sprayed, and fertilized.)

2. Do any of these take energy? (The machinery needs gas. Plants need sunlight to grow, etc.)

3. What kind of energy is used to produce these products? (Gasoline, solar, people, etc.)

Allow students to place the energy symbols on the posters by the item using that kind of energy. Do this on each poster from now on.

Dairy

1. What is coming to the dairy? (The milk truck from the farm.)

2. What happens at the dairy to some of the milk? (It's made into cheese for the pizza.)

3. Is energy used to make the cheese? (yes) What form of energy? (Electricity)

4. Are any other kinds of energy being used? (Gas) Place on symbols.

Slaughterhouse

1. We know that hamburger comes from beef. First, the beef must be cut up and then ground. How is energy used to do this? (The grinder is electric.)

2. Are any other things using energy? (The refrigerator, the truck, etc.)

3. What type of energy is being used? (Electricity, gas)

4. How do we get electricity? (Through wires) If no one knows you might like to tell them how your area gets it. Also explain that energy is used to produce it. Place on symbols.

Farm during Harvest

1. Much is happening here. Tell what you see. (Combining wheat, chopping corn, picking tomatoes.)

2. What is using energy? (Tractors, combines, people)

3. How do people use energy (When they work.)

4. Where do people get their energy? (Food)

5. So far has a lot of energy gone into the parts of our pizza? Place on symbols.

Tomato Processing Plant

1. Discuss the route of the tomato and howenergy is being used here.

2. Are people using their own energy here? (Yes, they have to make sure the machines are working right.)

3. Determine types of energy being used.

Place on symbols.

Flour Mill

1. Determine where energy is being used.

2. Have students decide what kind is being used.

3. Does anyone know how pioneers made flour?

4. What kind of energy did they use to do this? (Wind or water.)

Place on symbols.

Restaurant

Talking about all this has really made me hungry. How about you?

1. What else has to be done? (Get things to the restaurant. Put it together. Bake it.

2. Are these things being done in this picture?

3. Is energy needed anywhere?

4. What needs energy? (Oven, refrigerator, lights, trucks, people, car etc.)

5. What kinds of energy are used? (Electricity, gas, etc.) Place symbols on poster.

When all the posters are done place them on the chalkboard tray and allow time for students to look at them. Then ask:

1. Which picture has the most energy symbols on it?

2. Which kind of energy was used the most?

3. Can you think of any ways that some of this energy could have been saved?

4. Do all products need energy to be produced?

5. Was energy used to build the tractor the farmer used?

6. How about the oven in the restaurant?

Many other questions could be asked at this time or posters could be left out for students to discover over a period of time other things about energy use in these situations.

This lesson could take a long time to complete so you might like to complete it over a two-day period.

SUGGESTED FOLLOW-UP ACTIVITIES:

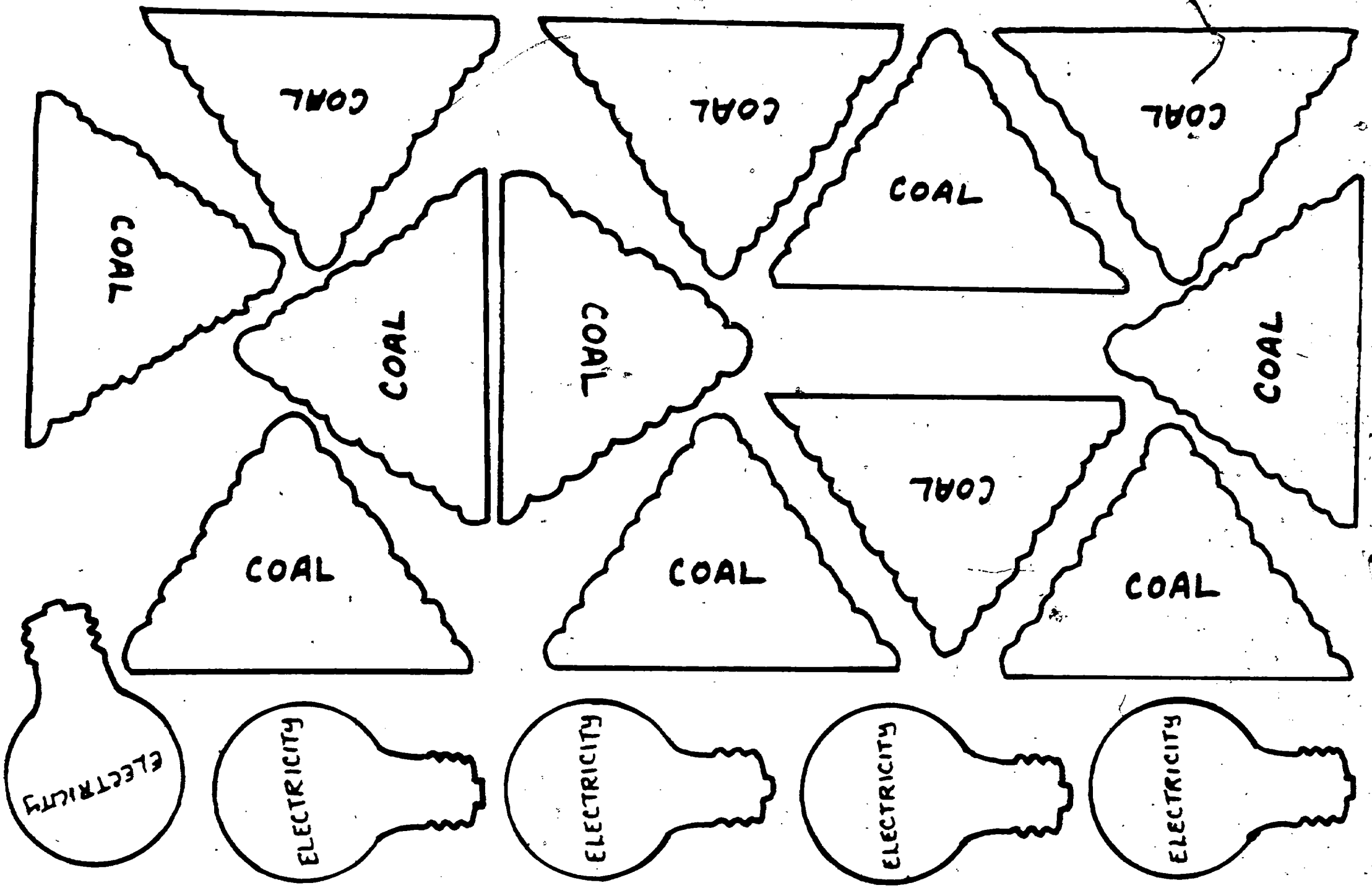
1. Graph the energy use by types of energy used in the poster story by using the symbols for the younger children.

2. Design a model to reduce energy use in making pizzas.

3. Visit a pizza parlor to actually see the energy for that step in use.

4. Make a pizza from scratch in your classroom by grinding the wheat, making your own sauce, and everything else.

5. Have the students make energy use scrapbooks showing the different types in use.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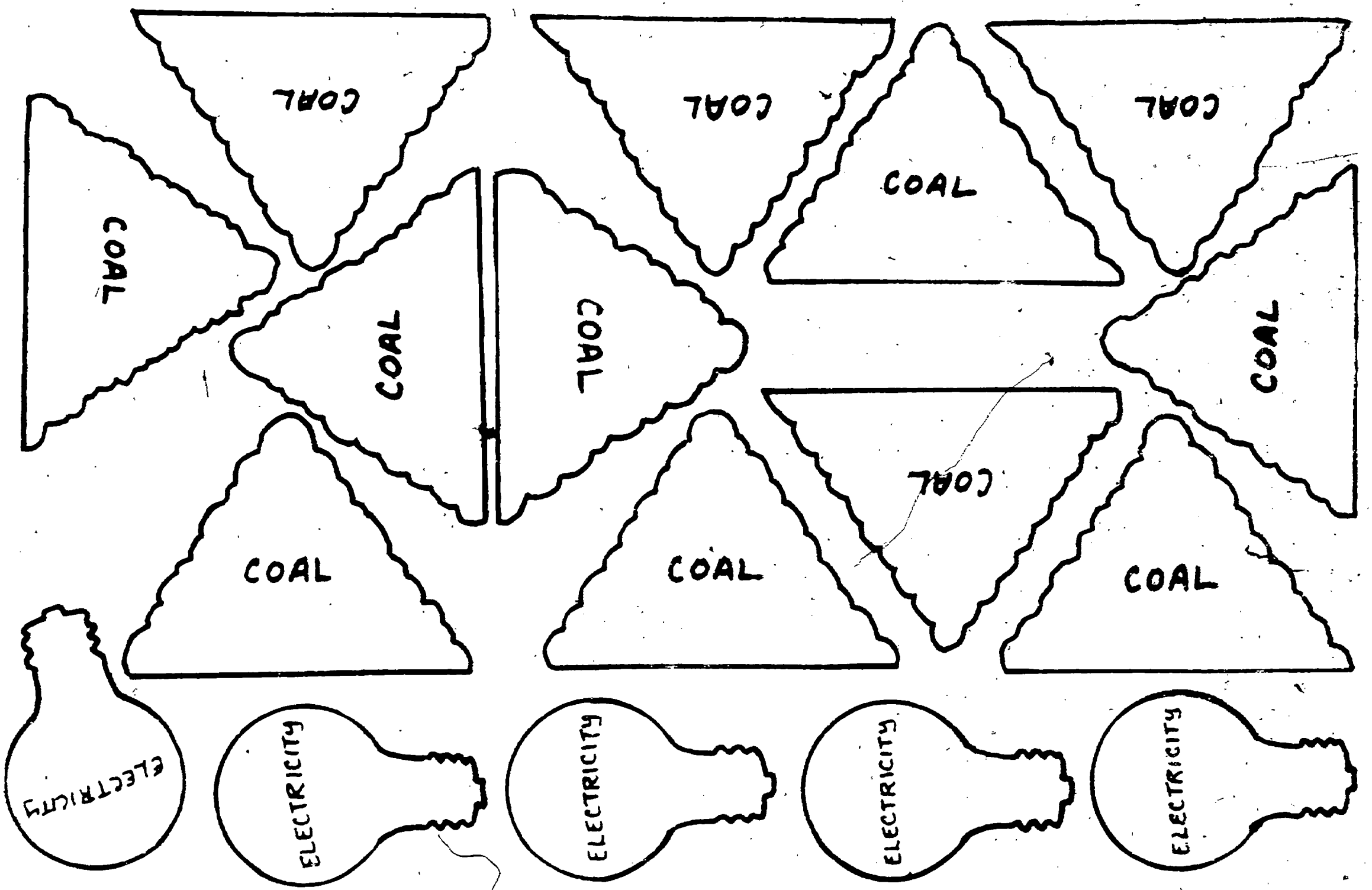
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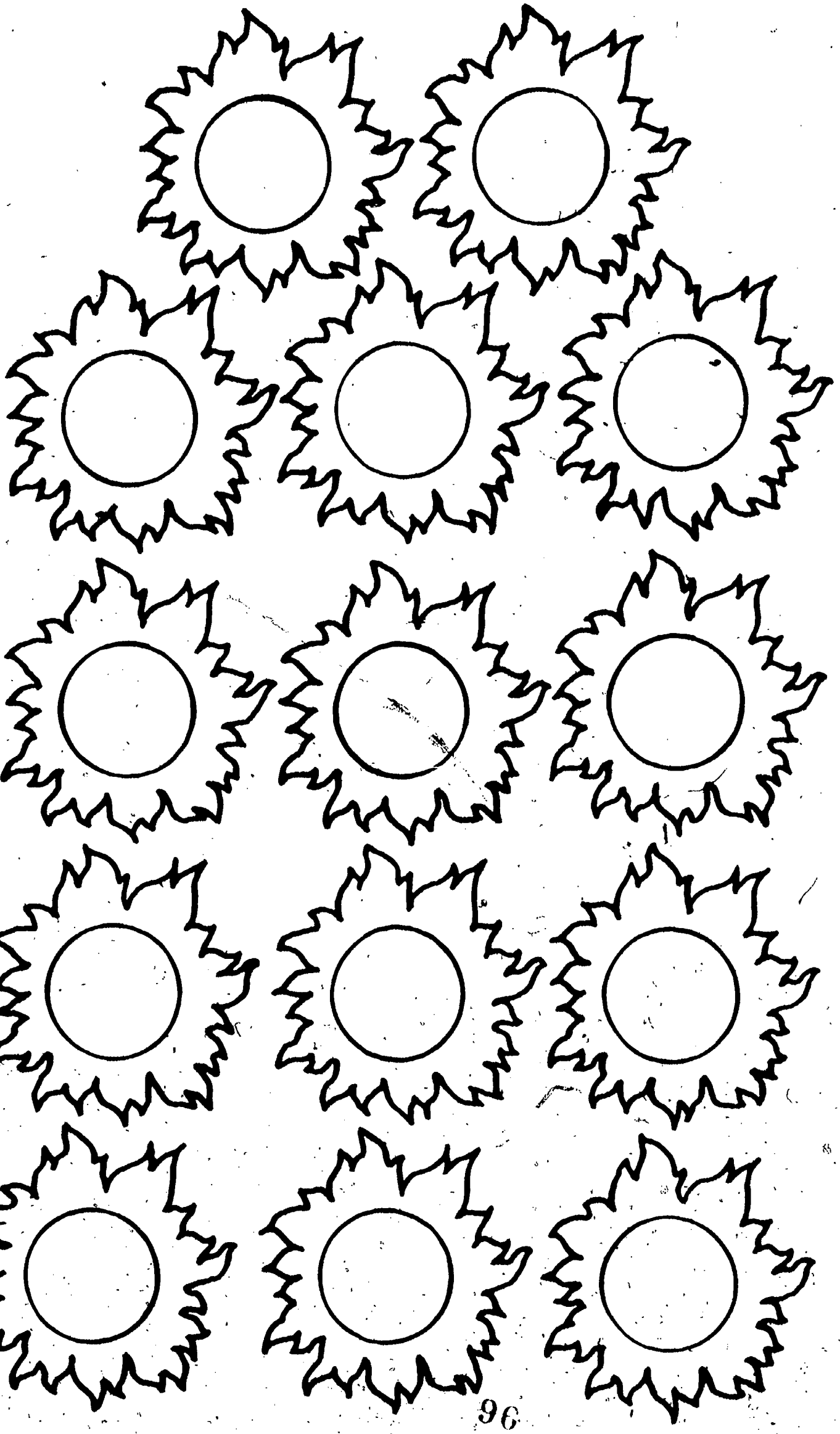

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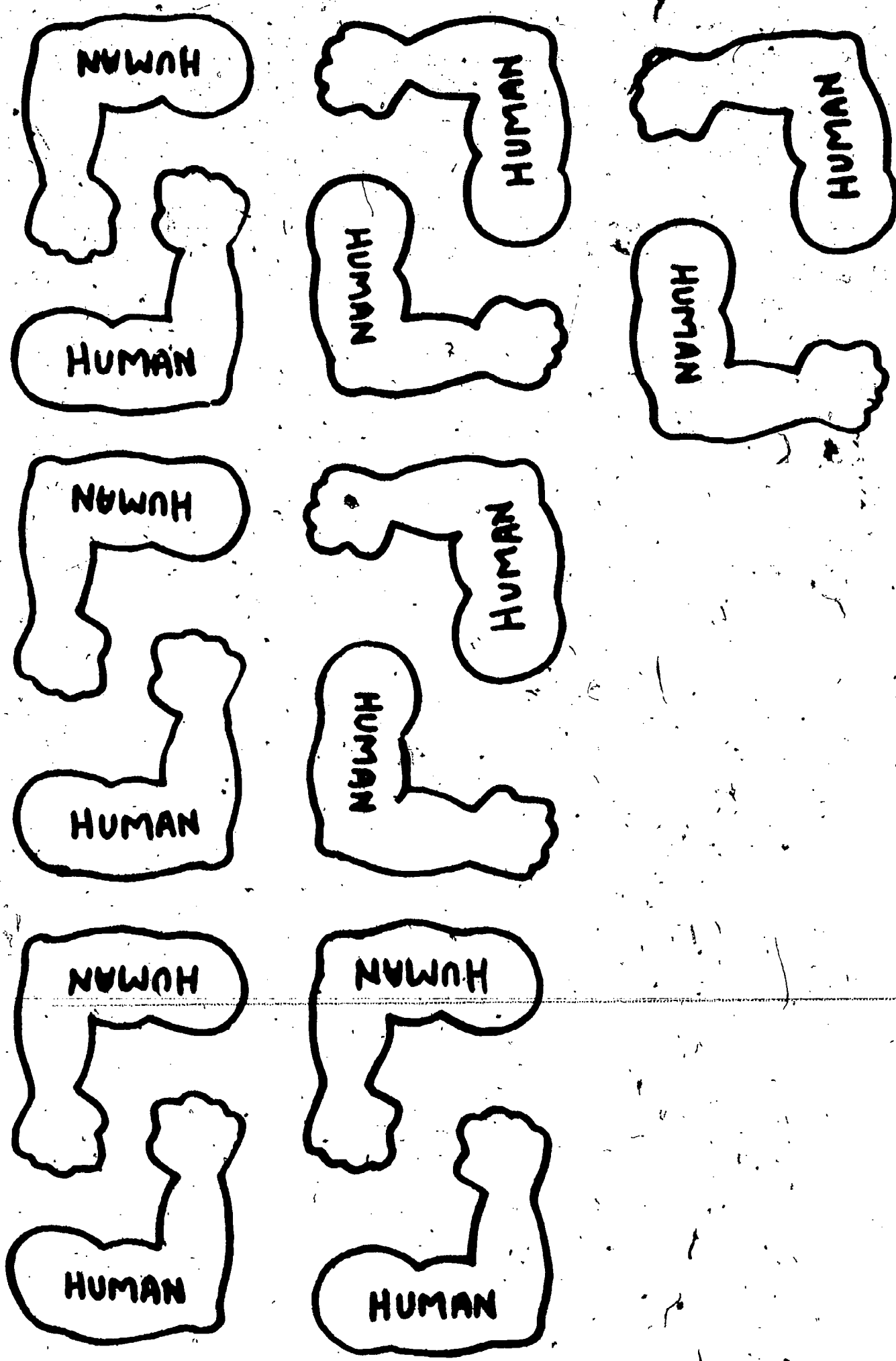
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CONSERVING ENERGY IN MY SCHOOL

by Dottie Miller

ACTIVITY: Conserving Energy in My School - A 5-day Unit (Intermediate)

ACTIVITY DESCRIPTION:

Students will become involved in promoting energy conservation at school beginning in their own classroom. They will tour the school building to find ways to conserve energy throughout the school and these ideas will be depicted on murals. The culminating activity will involve the principal of the school in a classroom discussion about conserving energy at school. The final result should be an all-out effort by students, teachers, administrators and other school personnel to conserve energy at school. The students will see that their efforts can make a difference.

ENERGY CONCEPT:

Schools as institutions can serve as models for energy conservation both in building energy use and in attitudes of personnel (students, teachers, administrators and staff).

OBJECTIVES:

Students will be able to list energy conservation measures for their classroom.

Students will be able to locate areas in the school building where conservation measures can be instituted.

Students will be able to depict energy conservation measures to be used at school through various art media.

Students will be able to present practical, worthwhile ideas about conservation of energy at school to the principal.

CONTENT:

Conservation of energy is important in all areas of our lives. Schools have a great potential for conservation both in the school

building's use of energy and in each person's energy use while at school. Students can have an impact on decisions made about energy consumption at school by making a systematic effort to discover possible energy conservation measures and by presenting these ideas to the administration.

MATERIALS:

Paper and pencils, crayons, notepads, mural paper, colored chalk, paint, magazines, other art materials.

VOCABULARY:

Conservation, institution, community, practical, mural, influence,

STRATEGY:

Day 1:

Develop a meaning for conservation of energy. What will happen if we don't conserve? What difference will it make if we do? Why is it important for each one to do his part? How does one person's conservation aid in the larger problem? How does one school's conservation help in the world community?

Have students point out ways of conserving energy in their own classroom. Make a list together with them. Have students mentally tour the school and make another list of how energy could be conserved in the building. (i.e., places where warm air escapes: weather stripping, open doors, caulking, insulating, unnecessary use of lighting, heating, cooling rooms that could be closed off, thermostats turned down, etc.) Have a student make a copy of these lists to keep for remaining units of this lesson.

Day 2.

Ask parents to come to school to help lead tour groups. Divide class into groups of approximately six students and one adult. Select

a secretary and a chairperson from each group. Furnish a notepad for each group to record ideas.

Set a time limit, and have each group tour the entire building, including boiler room, janitor's room, classrooms, office, bathrooms, etc. The secretary will record ideas on notepad to share with class.

Upon return to classroom, chairperson will give a brief report on ideas found by the group.

Teacher will collect notes for use in next day's lesson.

Day 3.

Each chairperson will report the group's findings to the whole class. A master list will be written on chalkboard as the group lists are presented.

Careful discussion of each idea should bring out whether the idea is practical and applidable to the school.

A new master list can then be made which includes only the ideas that the total class feels will work.

Day 4.

Students will again be in groups and each group will make a mural using a variety of art media to depict one of the energy-saving ideas from the composite list. These murals will be hung around the room to be used for discussion with the principal on day 5.

Day 5.

A time will be arranged with the principal for him/her to come to the classroom.

One student will be selected from each mural-making group to present the energy-saving idea to the principal, using the group mural as a visual aid.

An attempt will be made to convince the principal of the practicality of each idea and the need for the school to be involved in energy conservation.

ENERGY MENU

by Wendy Berkheimer

ACTIVITY: Energy Menu (Intermediate)

ACTIVITY DESCRIPTION:

Students will plan menus for meals based first on likes and dislikes and then on energy costs associated with food production. These lessons are planned to increase student awareness of the energy inputs necessary to produce the foods we buy at the grocery store.

ENERGY CONCEPT:

The food industry, from farming to processing to packaging to transportation, is a highly energy intensive one. We, as consumers through wise shopping habits, can reduce this energy use.

OBJECTIVES:

The student will compare energy costs of different foods.

The student will explore explanations of the energy costs of different foods.

The student will indicate how wise food choices can save energy.

CONTENT:

Every product we make or use has hidden energy and environmental costs. The high productivity of the American food industry depends on large quantities of energy to produce, process, transport, store, and prepare a large variety of foods. Any food product should be viewed as multiple energy investments. The further we are from our source in distance, time, and processing, the greater the indirect energy investments. There are ways we can conserve energy in our selection of food products.

MATERIALS:

Menu hand-outs (included)

paper and pencils

STRATEGY:

(4 lessons are included)

LESSON 1: An ENERGY MENU - Part I

LESSON 2: ENERGY IN FOODS - Part II

LESSON 3: FOOD CYCLE ENERGY STEPS - Part III

LESSON 4: ENERGY MENU - Part IV

Lesson 1: An Energy Menu

I. Handout "Lunchtime Menu"

II: Work through with students - if feasible, fill out one for yourself!

A. Students are to make choices according to what they would like to eat for lunch with no other considerations.

B. If students question specific types of food (i.e. what kind of luncheon meat), they may have their choice.

C. When everyone has finished making their selections, read off prices from corresponding sheet labelled "Energy Prices." Have students fill in relevant prices beside their check marks.

D. Have students add to find total. Include both first and second choices.

1. Students may find it easier to recopy all prices where indicated so they can line up numbers.

2. Column addition is a good exercise in grouping numbers. If students have difficulty, have them work with a peer.

E. Encourage students to suggest reasons why some food is more "energy expensive" than others.

1. Use explanatory comments from "Energy Prices" sheet according to student interest.

2. This concept will be explored further in the following activity.

ACTIVITY MASTER #1

NAME _____

DATE _____

LUNCHTIME MENU

DIRECTIONS: Order what you would like for Lunchtime. Choose a first and second choice in each group. Put a ✓ on the line.

DRINKS	$ Price $
Milk (usually in throw-away containers)	
Chocolate Milk	
Soft Drink (in a returnable bottle)	
Kool-aid	
Water	
SANDWICHES	
Luncheon Meat	
Turkey	
Hamburger	
Egg Salad	
Peanut Butter	
VEGETABLE (Sorry, today we have only carrots; but you may choose the kind you want.)	
Fresh carrots	
Frozen carrots	
Canned Carrots	
OPTIONAL ITEMS - May order if you wish. No more than two.	
Fresh Fruit (in season)	
Potatoe Chips	
Pretzels	
Ice Cream	
Cookie (2)	

LIST ALL PRICES HERE:

_____ _____

_____ _____

_____ _____

_____ _____

_____ ✓ Total Bill

THANK YOU AND COME AGAIN!

TEACHER PAGE

ENERGY PRICES

(Prices are arbitrary, but reflect the energy price relative to each other.)

DRINKS		PRICES
Milk (usually in throw-away containers)		.35¢
Chocolate Milk		.45¢
Soft Drink (in a returnable bottle)		.30¢
Kool-aid		.20¢
Water		.10¢
SANDWICHES		
Luncheon Meat	(Animals are inefficient converters of protein. A pound of meat requires about four times the energy to produce and market as a pound of vegetable protein. Some animals are more efficient converters of protein than others.)	$1.60
Turkey		1.15
Hamburger		2.00
Egg Salad		1.00
Peanut Butter		.90
VEGETABLE		
Fresh carrot		.12
Frozen carrots		.30
Canned carrots		.25
(Processed vegetables require more energy than fresh vegetables; freezing especially requires large amounts of energy to process and to store)		
OPTIONAL ITEMS		
Fresh Fruit		.25
Potatoe Chips		.50
Pretzels		.50
Ice Cream		.60
Cookies (2)		.50

Lesson 2: Energy In Foods

Procedure

I. Distribute "Food Chain" handout (ditto master #2).

II. Discuss energy use at each step (sample questions and some sample answers are given, accept all reasonable responses.)

(Students may jot notes on their food chain sheets during discussion)

A. Plants: Does it take energy for vegetables or grain to grow? (Sun's energy) How else is energy used in growing wheat? (Machinery, fertilizers...). Does it take energy to get the grain from the ground into the cow? Explain. Would you say it takes a lot of grain to raise a cow?

B. Beef Cattle: How is energy used in raising beef cattle? When you want a hamburger you don't buy a cow - what do you buy? How is energy used to get from a beef cattle to hamburger sold at the store? Is energy used in the meat package? How?

C. Hamburger: How is energy used in making a hamburger? Where does the energy in the hamburger go? (In the boy) How does he/she use that energy? (run, play...)

D. Think about how much energy it takes to make different foods. In which of these foods would you be 'eating' more energy? Fresh vegetables or a steak? Fresh carrots or frozen carrots?

E. Take a hand count - agree/disagree/not sure. With statement: The more steps between the sun and the food we eat, the more energy it has taken to produce that food. (answer: agree).

EXTENSION ACTIVITY: Have interested students add the steps brought out in discussion to the Food Chain . Make a chart for room display.

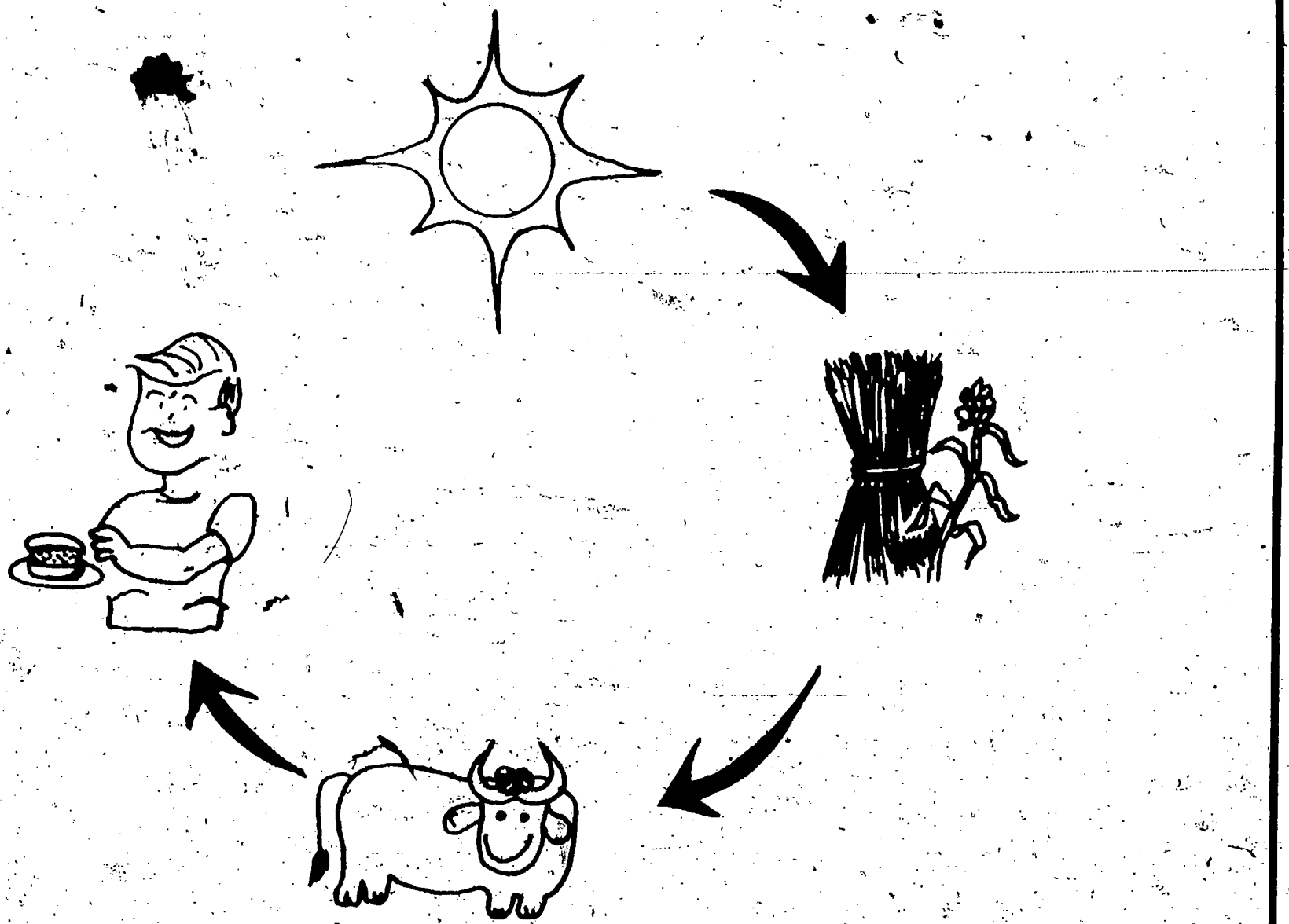


Figure 54. The Food Chain.

Lesson 3: Food Cycle Energy Steps

I. Distribute handout 3 "Food Cycle Energy Steps."

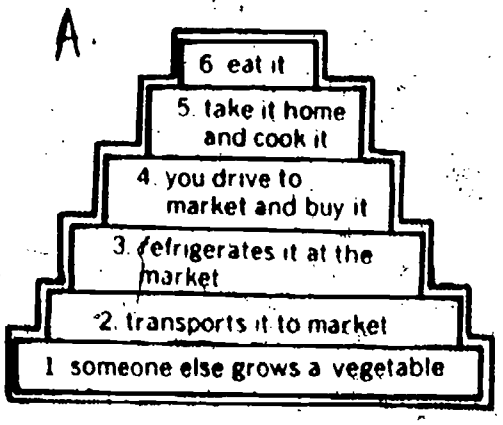
II. Read through twelve steps together. Be sure students can tell you how energy is being used at each step. For example:

A. Step 11. Throw-away package. Energy is used in making the plastic wrapper, (pure petroleum!) and in putting vegetable into wrapper.

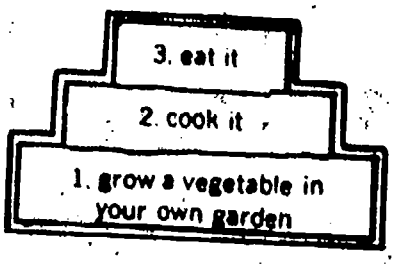
B. Step 7. Store keeps it frozen. Energy is used to keep freezer cold. Ask students if they have ever noticed a cold fogginess escape when they open a freezer door inside a store. How many times do you think those doors are opened? Have you ever seen frozen food section that didn't have a door or lid? Check next time you go to the store.

III. Work through the exercise as a group using students' suggestions on steps that could be left out or changed. Write changes on worksheets. Below are possible answers.

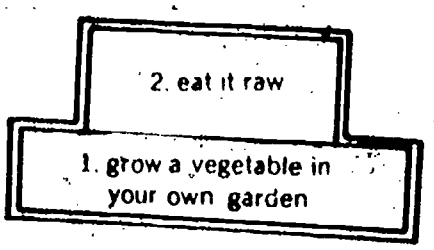
A.



B.



C.



IV. Have students construct the steps (as above) in a canned soft drink food cycle. Students may enjoy working in partners. Together go through steps, changing and crossing to conserve energy.

V. This makes a nice bulletin board display for interested students.

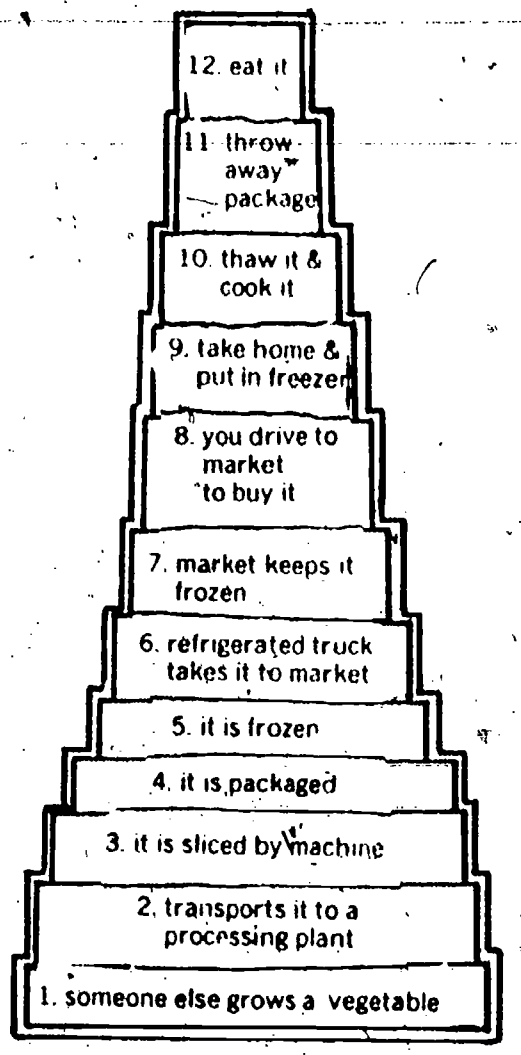
ACTIVITY MASTER #3

NAME _____

DATE _____

FOOD CYCLE ENERGY STEPS

DIRECTIONS: Twelve steps in a frozen food system are pictured below. Show which steps could be crossed out or changed so that less energy is used before the vegetable gets in your mouth.



Now - turn this paper over and see if you can trace the steps in a food system for your favorite canned soft drink. Can any of the steps you've drawn be crossed out or changed to conserve energy?

111

Lesson 4 - An Energy Menu - Part II.

I. Hand out "Dinner Menu".

II. Students are to make "energy conscious" choices, thinking about the natural food chain as well as packaging energy costs. Have students fill out individually as you circulate.

III. When students have finished, read off prices. Have students fill in relevant prices beside their checkmarks.

IV. Have students recopy prices in one list, then add to find total. They may want to work in pairs.

V. Conduct overview having students explain the different energy costs involved in the dinner menu. Sample questions.

A. Why would frozen orange juice cost more in energy terms than fresh orange juice?

B. Why would a bean taco cost less in energy terms than all the other main dish choices?

C. Explain the energy cost difference in the way broccoli is prepared.

D. Why would ice cream cost more energy than homemade cookies? Which do you think would cost more energy - two homemade cookies or two store bought cookies? Why?

EXTENSION ACTIVITY

Bring in collected restaurant menus.

1. Have interested students list five high energy costing items and five low energy items. Caution: actual prices on menus may not reflect energy costs.

2. Have interested students order a meal and explain why they made their choices in terms of energy costs.

FOLLOW-UP ACTIVITIES:

I. Tell students to make a list of everything they eat for dinner that night.

A. Be specific; if you have vegetables, find out if they were canned or fresh.

B. Suggest to students that they do assignment as they help parent prepare dinner.

II. Have students bring in their food lists and compare - together or in small groups. How could we have eaten less as far as energy costs?

III. Have students write a letter to their families including the following components:

A. Why the assignment (our class has been studying...).

B. One specific change the student would like to see his/her family adopt in their selection of food products. Better to keep suggestion small (i.e. trying canned juice rather than frozen, boxed pizza rather than frozen pizza.)

C. Why this change would represent an energy savings.

D. Have peer partners proof-read rough drafts. Write final copies and take home.

ACTIVITY MASTER #4

NAME _____

DATE _____

DINNER MENU

DIRECTIONS: Think about the energy used in each food product. Choose one choice from each group. Try to conserve energy by making wise choices. Also choose items you would eat - waste also costs energy!

DRINKS	$ PRICE $
Milk	_____
Frozen Orange Juice	_____
Fresh Orange Juice	_____
Soft Drink (in returnable bottle)	_____
MAIN DISH	
Egg Omelet	_____
Turkey	_____
Roast Beef	_____
Bean Taco	_____
VEGETABLE (This evening, the vegetable is broccoli. You may choose the kind you want)	
Fresh broccoli	_____
Frozen broccoli	_____
Canned broccoli	_____
DESERT	
Ice Cream	_____
Frozen Banana Cream Pie	_____
2 Homemade cookies	_____

LIST ALL PRICES HERE:

_____

_____

_____

_____

_____

ADD

_____ Total Bill

HOPE YOU ENJOYED YOUR MEAL!

TEACHER PAGE

ENERGY PRICES

(Prices are arbitrary but reflect the energy price relative to each other)

DRINKS	PRICES	
Milk	.35	
Frozen Orange Juice	.45	(requires large amounts of energy to freeze and store)
Fresh Orange Juice	.15	
Soft Drink (In returnable bottle)	.30	
MAIN DISH		
Egg Omelet (Some animals are more efficient converters of protein than others. It takes approximately four times as much grain to produce a pound of beef than it does to produce a pound of turkey)	$1.25	
Turkey	1.75	
Roast Beef	2.50	
Bean Taco	1.00	
VEGETABLE		
Fresh Broccoli	.15	
Frozen Broccoli	.30	
Canned Broccoli	.25	
(Processed vegetables require more energy than fresh vegetables; freezing especially requires large amounts of energy to process and to store.)		
DESERT		
Ice Cream with Nuts	.75	
Frozen Banana Cream Pie	1.00	
Two homemade cookies	.40	

REFERENCES

Energy Conservation in the Home - An Energy Education/Conservation Curriculum Guide for Home Economics Teachers. U.S. Department of Energy, Oct. 1977.

Energy, Food and You. Office of Environmental Education, Washington, D.C.

Katz, Deborah and Goodwin, Mary T., Food: Where Nutrition, Politics, and Culture Meet. Center for Science in the Public Interest, Washington, D. C. 1976.

BUILD AN ENERGY EFFICIENT MODEL HOME

by Chuck Novak

ACTIVITY: Build an Energy Efficient Model Home (Intermediate, Middle School)

ACTIVITY DESCRIPTION:

Students will design and build an energy efficient "house" out of a shoe box. Tests will be made to examine the efficiency of these model houses.

ENERGY CONCEPT:

Home energy conservation can be enhanced by applying insulation, storm windows, weatherstripping, caulking, and landscaping to the home.

OBJECTIVES:

The student will be able to visualize an energy efficient home.
The student will understand how a home may become more energy efficient.
The student will build a model home to display energy conservation measures.

CONTENT:

Over one quarter of the energy used in the United States is used by people in their homes and cars. Home owners can substantially reduce their energy consumption at home by adding insulation, by caulking and weatherstripping doors and windows, by adding storm windows and insulated curtains, by properly landscaping areas around the home, and by insulating water heaters, furnaces, and pipes.

MATERIALS:

Shoe boxes (one for each "energy house"), paper clips, 60-75 watt light bulb and socket (one per each shoe box), 2 thermometers per shoe box, block of wood ½ inch thick to cover bottom of each shoe box.

Energy Conservation Materials:
- corrugated cardboard (insulation)
- styrofoam (insulation)
- saran wrap (storm windows)
- material scraps (curtains)
- clay (caulking material)
- straws and tape (water pipes with insulation)
- paper & cardboard (for landscaping with trees and bushes)

VOCABULARY:

insulation
caulking
weatherstripping
landscaping
conservation
energy efficiency
storm windows

STRATEGY:

1. Review as a class, ways of making a house more energy efficient. Discuss ways in which the students could illustrate these methods in their "energy house".

   A. Insulation - pieces of corrugated cardboard (old styrofoam containers) on the inside, bottom, and top of the box.
   B. Storm windows and doors - an inside and an outside window made out of Saran Wrap and cardboard.
   C. Insulated curtains - material scraps.
   D. Caulking windows and doors - clay.
   E. Insulate hot water pipes - straws and tape.
   F. Trees around house - paper and cardboard.
   G. Attic fan instead of air conditioning - cardboard.

2. Using paper clips, hang one thermometer on the inside and one on the outside of the same wall of the shoe box.

3. Inside the shoe box, lay a light bulb in a socket on a piece of wood. (Use a bulb with at least 60 watts but not over 100 watts) (The wood prevents the box and contents from burning.)

4. Record the readings of the thermometer. Close Cover.

5. Allow the light bulb to burn for 5 minutes.

6. Record the increase in temperatures on both thermometers.

7. Have the students cut in windows and doors.

8. Repeat steps 3 - 6.

9. Have students make their "energy house" more energy efficient. (Use at least 5 different methods)

10. Repeat steps 3 - 6.

11. Discuss the results of the assignment with the whole class.

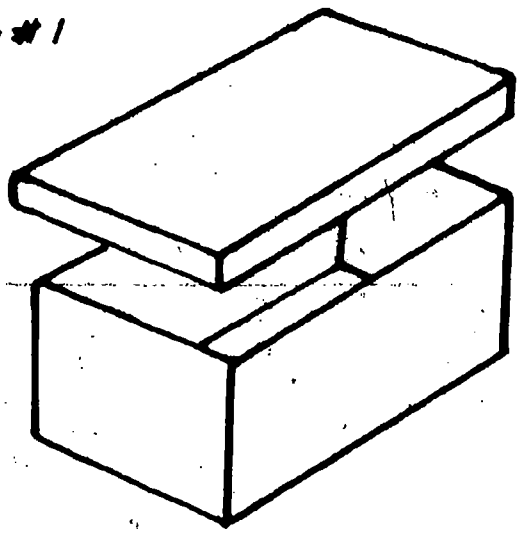
FOLLOW-UP ACTIVITIES:

1. Test completed project for heat lost by wind. Use a portable fan as a wind source. Place "trees" or wind break in appropriate places.

2. Test the difference in insulation between using storm windows and no storm windows.

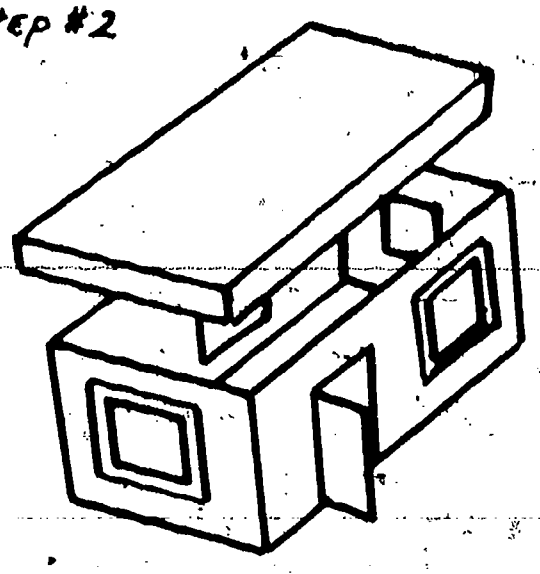
3. Test the difference in insulation when house has a pointed roof instead of a flat roof.

Step #1



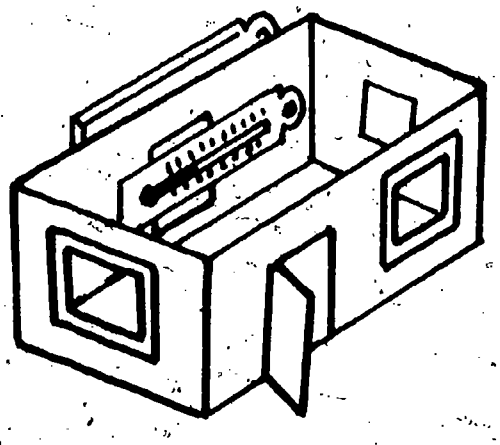
-decorate the outside of a shoe box to resemble a house

Step #2

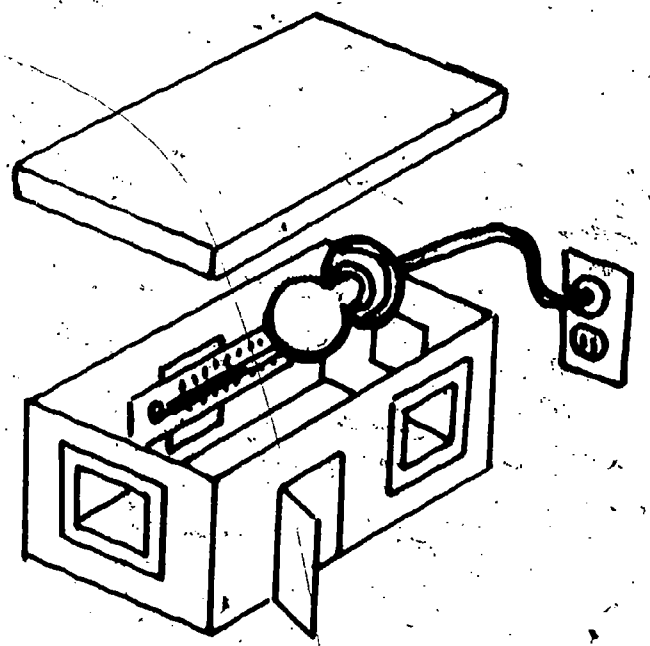


-USE CELLOPHANE OR PLASTIC WRAP TO SIMULATE WINDOW PANES OF GLASS. CUT A WINDOW IN EACH WALL AND A DOOR

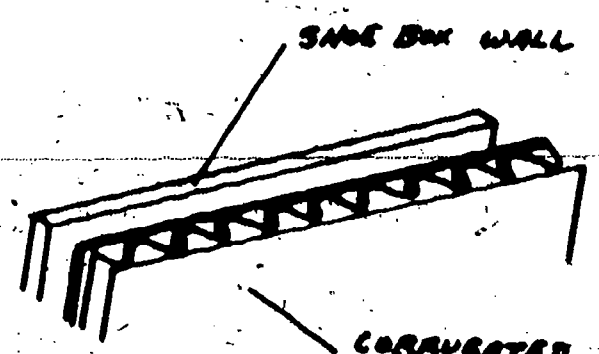
Step #3

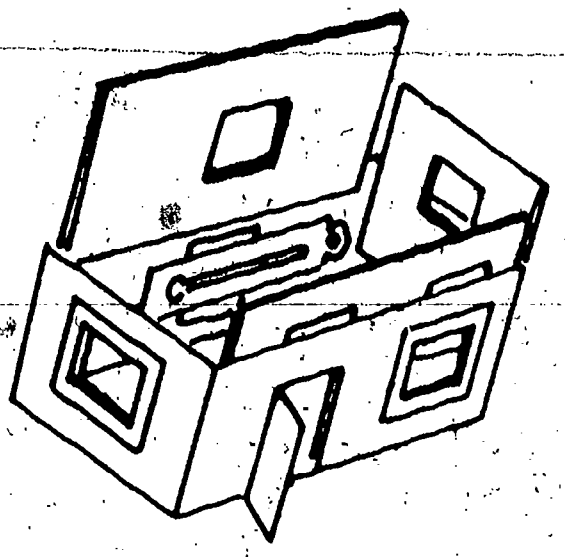


- PLACE A THERMOMETER ON THE OUTSIDE OF THE REAR WINDOW AND ONE OVER THE INSIDE FACE OF THE REAR WINDOW.



- PLACE A 75 WATT BULB INSIDE THE HOUSE TO SIMULATE CENTRAL HEATING. MEASURE THE TEMPERATURE READING DIFFERENCE BETWEEN THE INSIDE AND OUTSIDE THERMOMETERS WITH THE "ROOF" OR LID IN PLACE.





- cut panels from a corrugated carton to match the interior walls, floor and roof
- the corrugated walls represent insulation
- add a storm window of cellophane with about 1/4" of air space between it and the original window on each wall
- add a corrugated door to act as a storm door
- place a piece of scrap wood or wooden wall paneling to cover the floor of the house
- repeat the experiment with this insulation in place and note the effect the insulation has on the inside and outside temperature readings

ENERGY HUNT IN THE CLASSROOM

by Dale Patterson

ACTIVITY: Energy Hunt in the Classroom (The Law of Diminishing Return: Using More and More Energy to Get Less and Less). (Upper Elementary)

ACTIVITY DESCRIPTION:

Students will search for oil barrels (made of paper) in the classroom: A simulation exercise to illustrate the continuing use of a non-renewable resource.

ENERGY CONCEPT:

During the past several years the energy problem in our country as well as the world has increasingly become more acute. As the demand for energy (and the raw products that produce it) grows larger and the supply grows smaller, the costs to obtain it increases dramatically.

INFUSION IDEAS:

Will fit into any science, social science or mathematics class.

OBJECTIVES:

1. The student will be able to recognize there is a rapidly decreasing supply of oil in the world.
2. The student will be able to recognize that there are various means of securing oil as an energy source.
3. The student will be able to recognize that these various means of securing oil change in value from year to year.

VOCABULARY:

Finite resource, predicting, non-renewable, diminishing.

MATERIALS:

1. Paper cups (one for each student)
2. Paper oil barrels (students may cut, color, and label).
3. Poker chips or monopoly money.
4. Chart 2 available for Energy Council.
5. Optional - Can hand in poker chips for M&M's.

STRATEGY:

A. Directions for "Energy Hunt"

1. 100 barrels are colored, cut and labeled by students and hidden by teacher throughout classroom.
2. Energy Council consisting of six (6) students is selected (i.e. one for imports, new wells, old wells, off shore, Alaskan pipeline and shale.) The Energy Council should have 600 poker chips.
3. Five (5) poker chips are distributed to each student in a paper cup.

B. Rules

1. This game will use four intervals consisting of sixty (60) seconds each of which represents one year. Each year will be represented by a different colored oil barrel.
2. The box on each barrel will have been labeled according to directions in Chart 1.
3. Upon deciding to hunt for oil each student pays the Energy Council 1 poker chip.
4. Year one (60 seconds): Each student hunts for as many hidden blue oil barrels as can be found in this time interval.

NOTE: Students may opt to hunt in any given year. After 60 second interval each student receives an energy poker chip pay-off from appropriate energy council members.

Discussion may follow:

5. Year Two (60 seconds): Follow same procedure as for One Year using red barrels.
6. Year three (60 seconds): Follow same procedure as for Year One using green barrels.
7. Year Four (60 seconds): Follow same procedure as Year one using yellow barrels.

C. Strategies for Introducing "Energy Hunt"

1. Terminology for securing oil should be thoroughly discussed prior to the beginning of the game.
2. Predictions and hypotheses can be made in regards to which means of securing oil are more attractive now and in the future.
3. Class should be divided into groups representing countries and their search for oil in relation to their needs for oil.
4. Preliminary discussion could include: 1) oil as a source of energy is finite and 2) that the means for securing oil are becoming more costly.
5. Optional: Chart 2 could be made available to selective numbers of students to observe if their "hunting behavior" is different from those without Chart 2.
6. Amount of time allotted for each year could be modified in relation to the level in which "Energy Hunt" is used.
7. Have each member of the energy council tally the number of barrels found each year for that method of securing oil and how many poker chips were paid off each year. Discussion follows.

D. Focus Questions for Debriefing

1. Did the amount of oil we found each year decrease?
2. Did the poker chip payoff increase or decrease for Imports for each year? Why?
3. Did the poker chip payoff increase or decrease for New Wells for each year? Why?
4. Did the poker chip payoff increase or decrease for Old Wells for each year? Why?
5. Did the poker chip payoff increase or decrease for the Alaskan Pipeline for each year? Why?

6. Did the poker chip payoff increase for decrease for Off-Shore Drilling for each year? Why?

7. Did the poker chip payoff increase or decrease for Shale for each year? Why?

8. Were all 100 of the oil barrels found? Why?

9. Can we depend on oil as an energy source for the future?

10. What things in our country now depend on oil for their source of energy?

11. What are the different problems that using oil as energy cause us?

CHART 1

Color and Number of Barrels for Each Oil Source

	Barrel Color	Imports	New Wells	Old Wells	Off-Shore	Alaskan Pipeline	Shale
YEAR 1	50 BLUE	25	5	15	1	3	1
YEAR 2	25 Red	10	6	5	1	1	2
YEAR 3	15 GREEN	7	4	1	1	0	2
YEAR 4	10 YELLOW	3	2	1	2	0	2

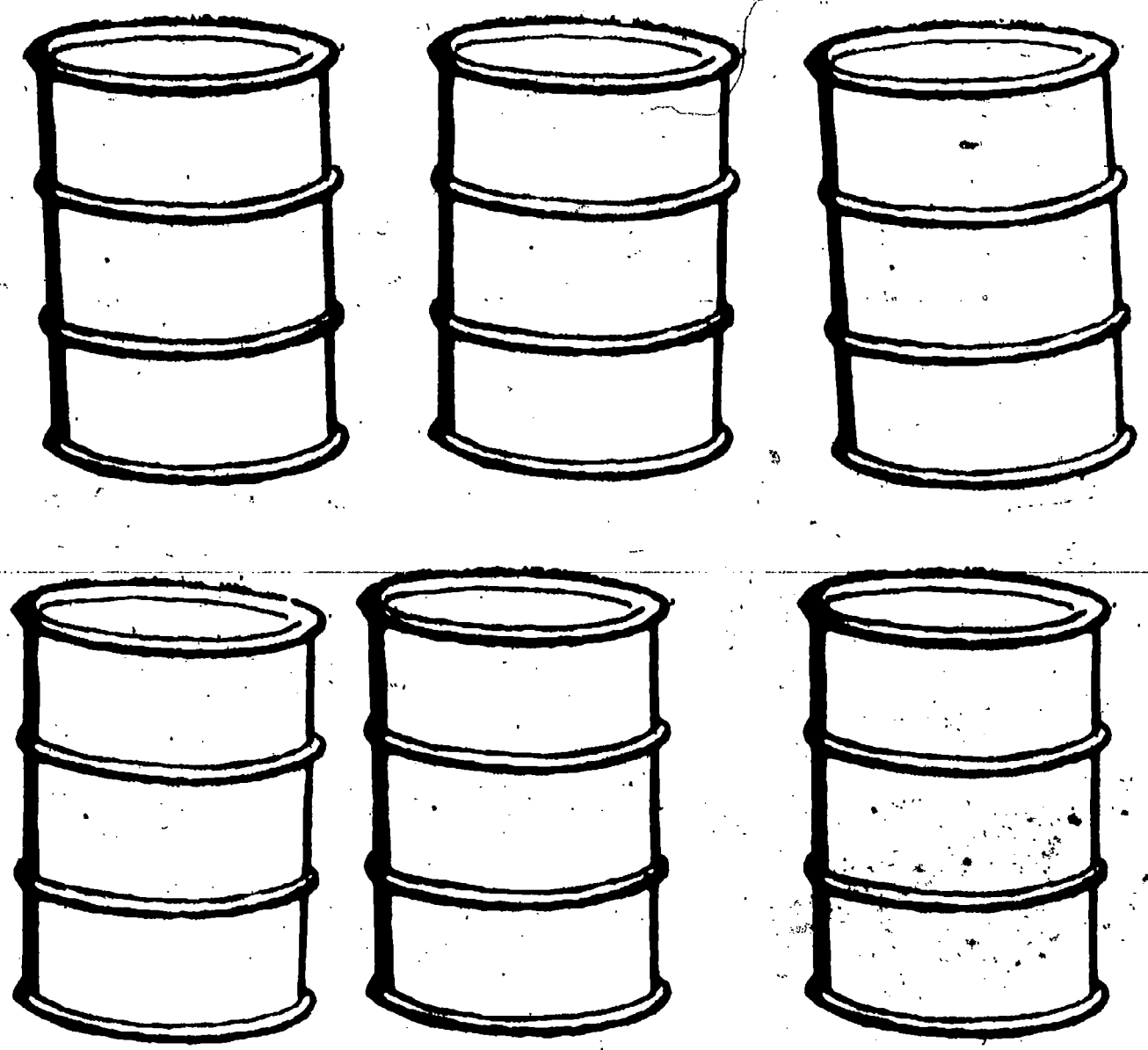
NOTE: Chart 1 for teacher's use only.

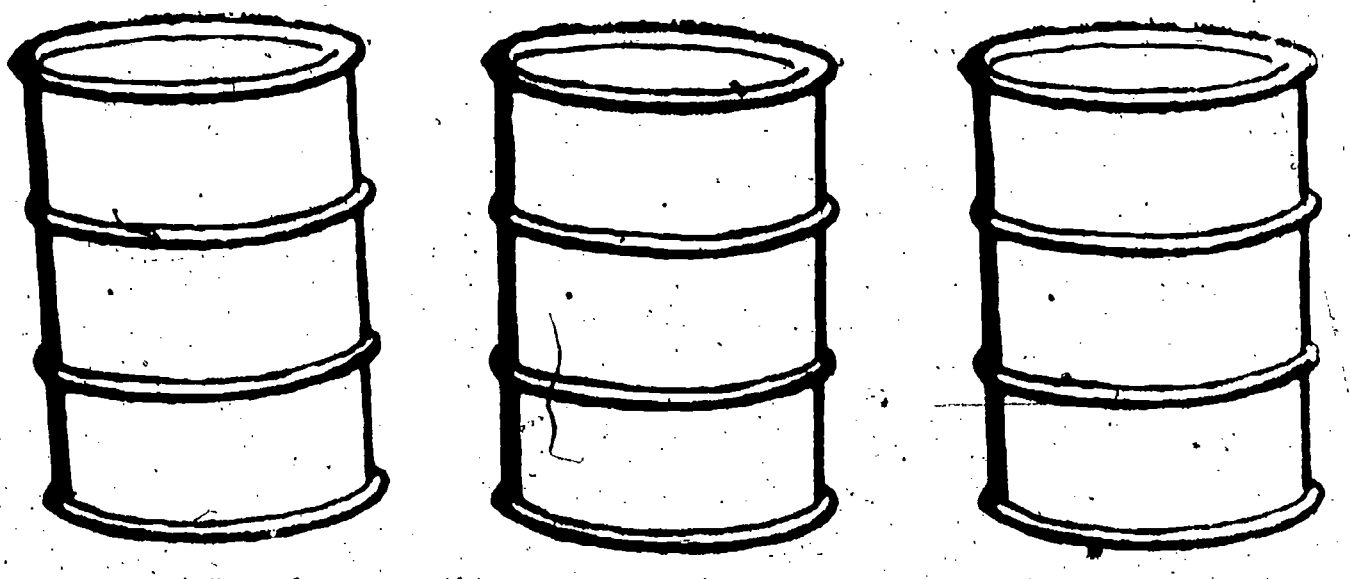
CHART 2

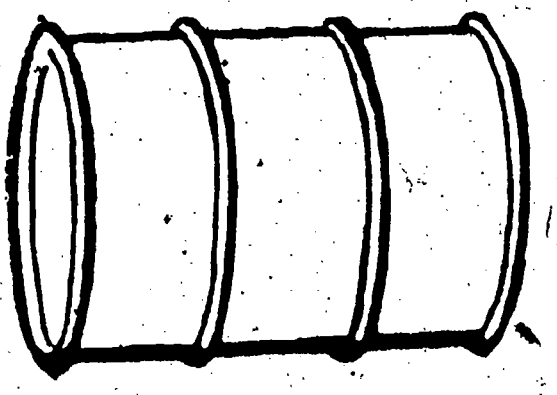
Poker Chip Payoff per Oil Source

	IMPORTS	NEW WELLS	OLD WELLS	OFF-SHORE	ALASKAN PIPELINE	SHALE
Year 1	4	4	4	1	1	1
Year 2	3	5	4	2	5	1
Year 3	2	4	2	3	0	4
Year 4	1	3	1	3	0	5

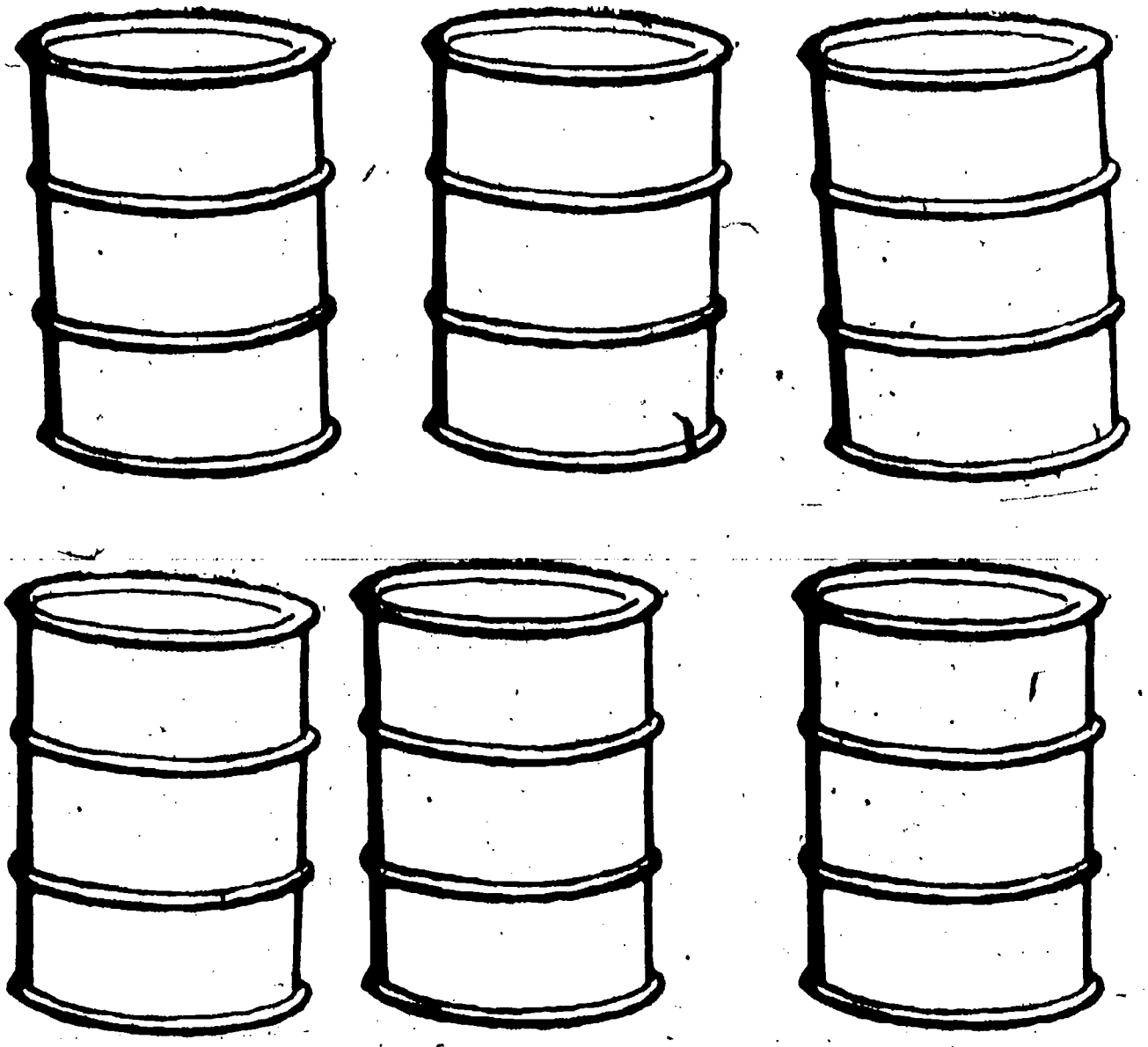
Note: This chart should be made available to Energy Council Members Only.







100 copies of this barrel should be made. Each is then colored, cut and labeled by the students according to Chart 1 prior to the beginning of "Energy Hunt."



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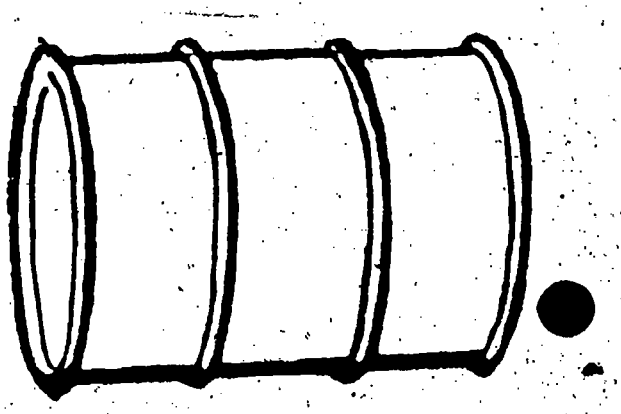

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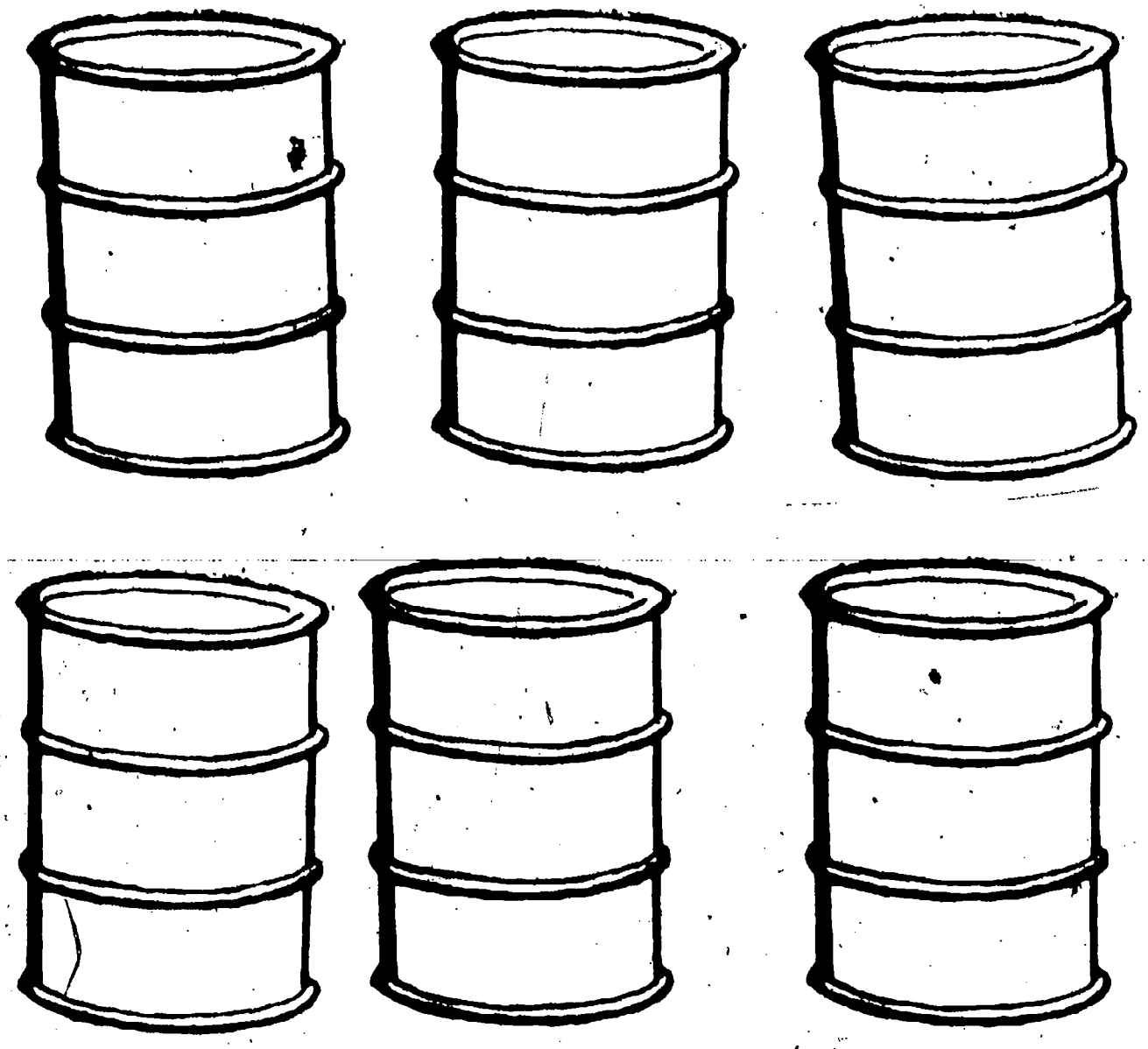

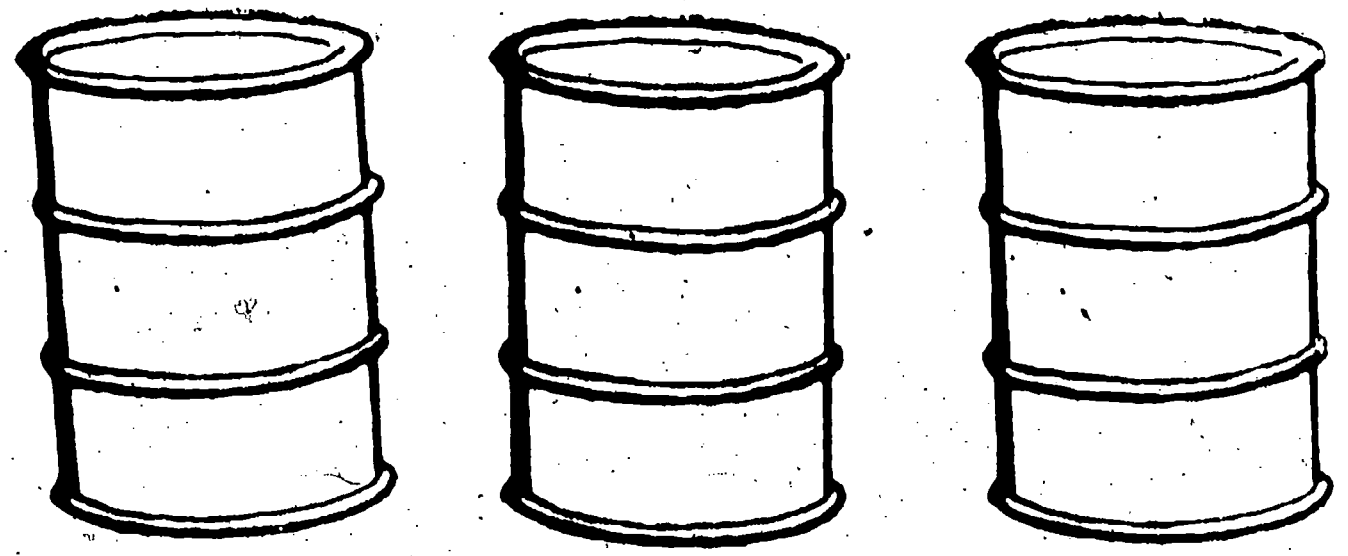

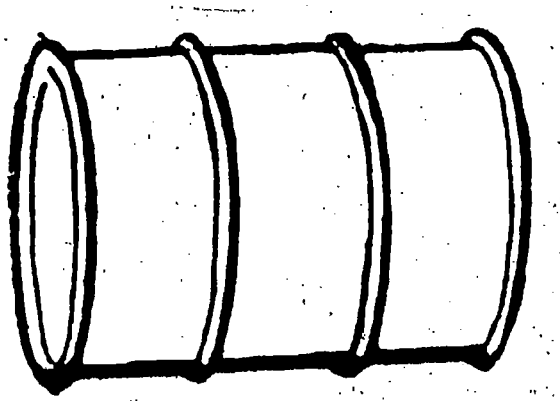

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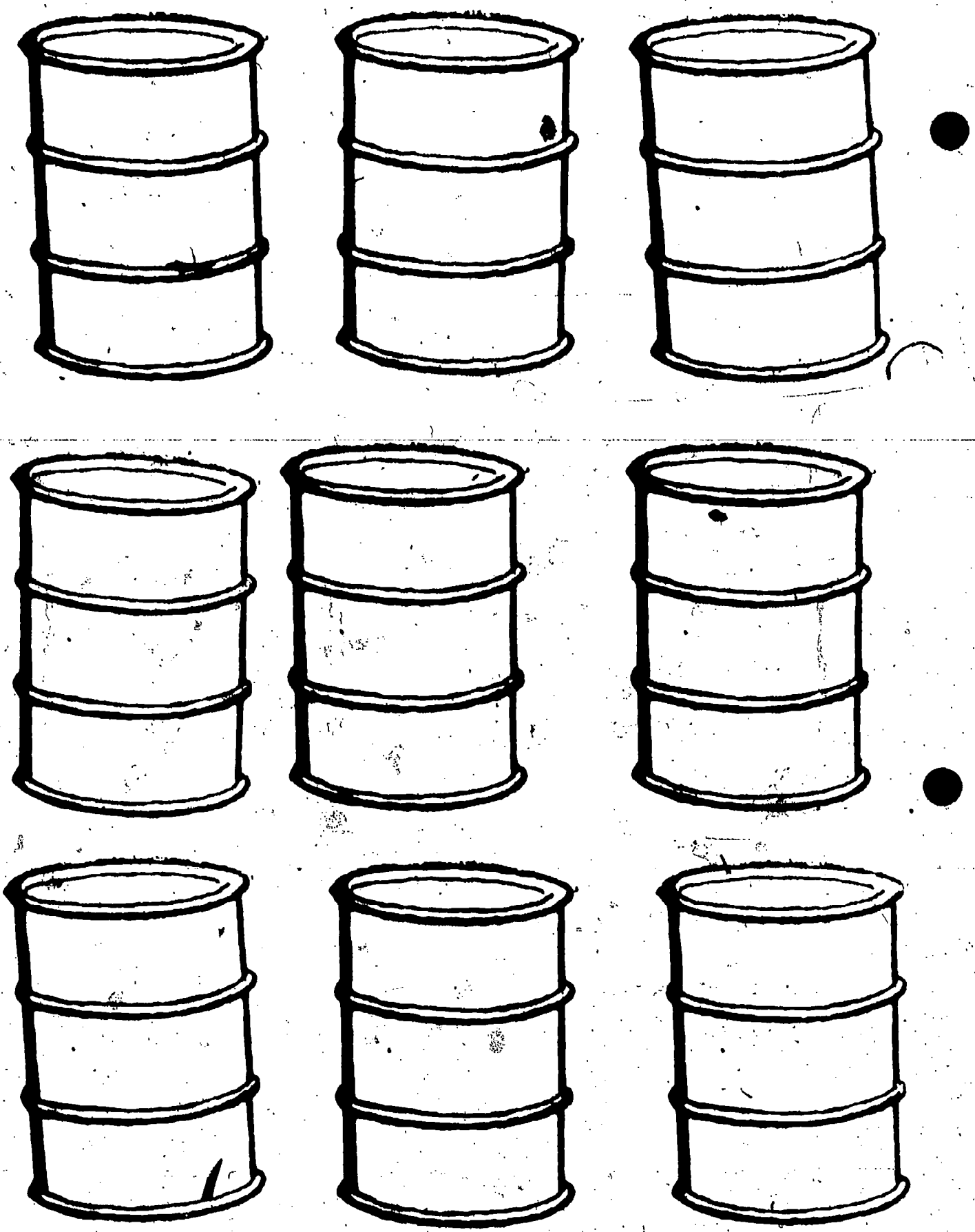
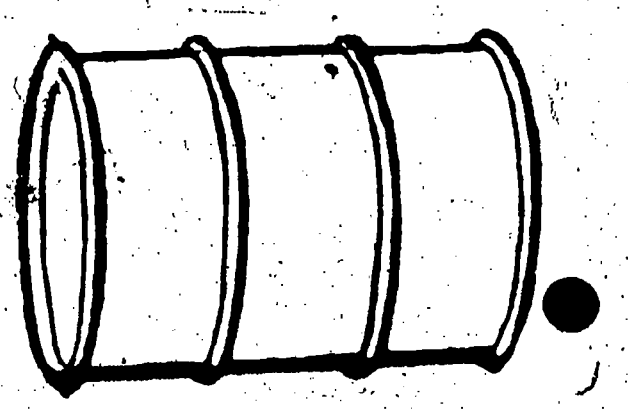
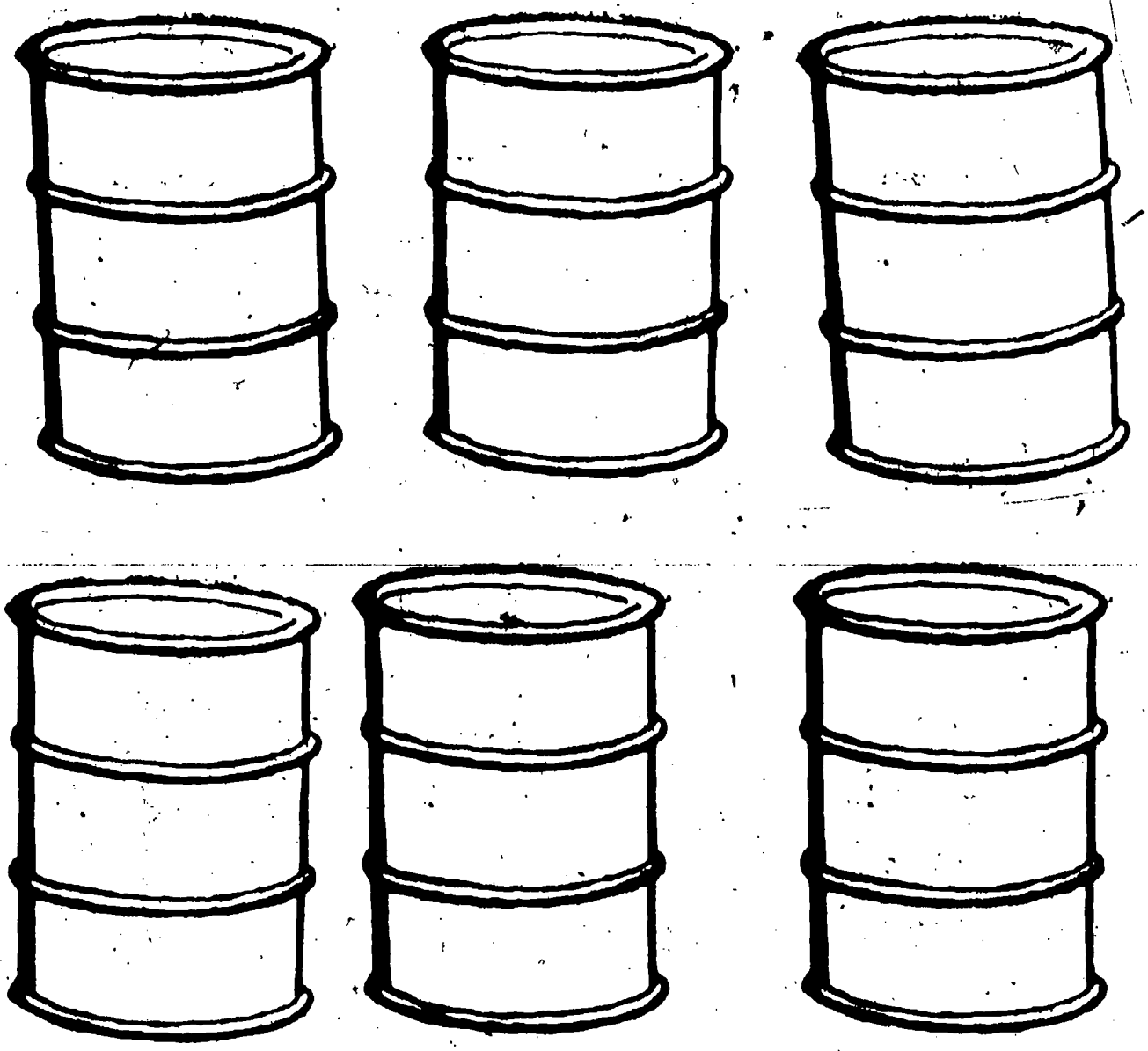
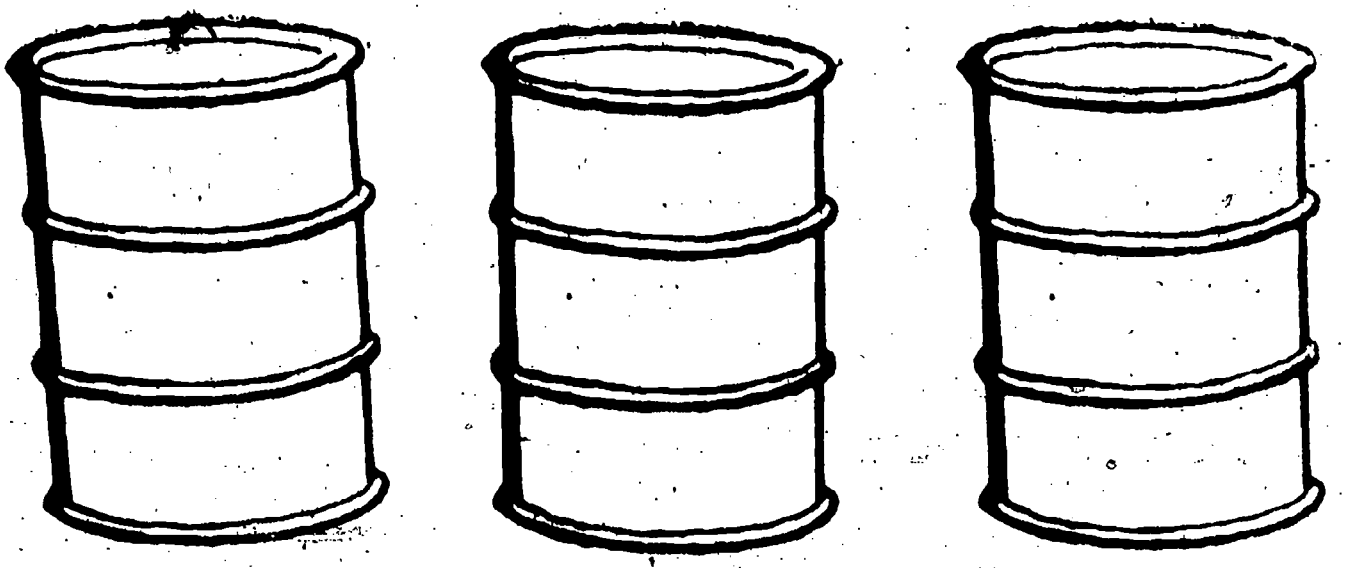
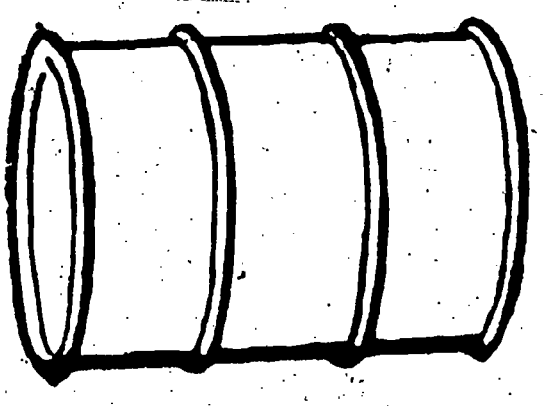


100 copies of this barrel should be made. Each is then colored, cut and labeled by the students according to Chart 1 prior to the beginning of "Energy Hunt."









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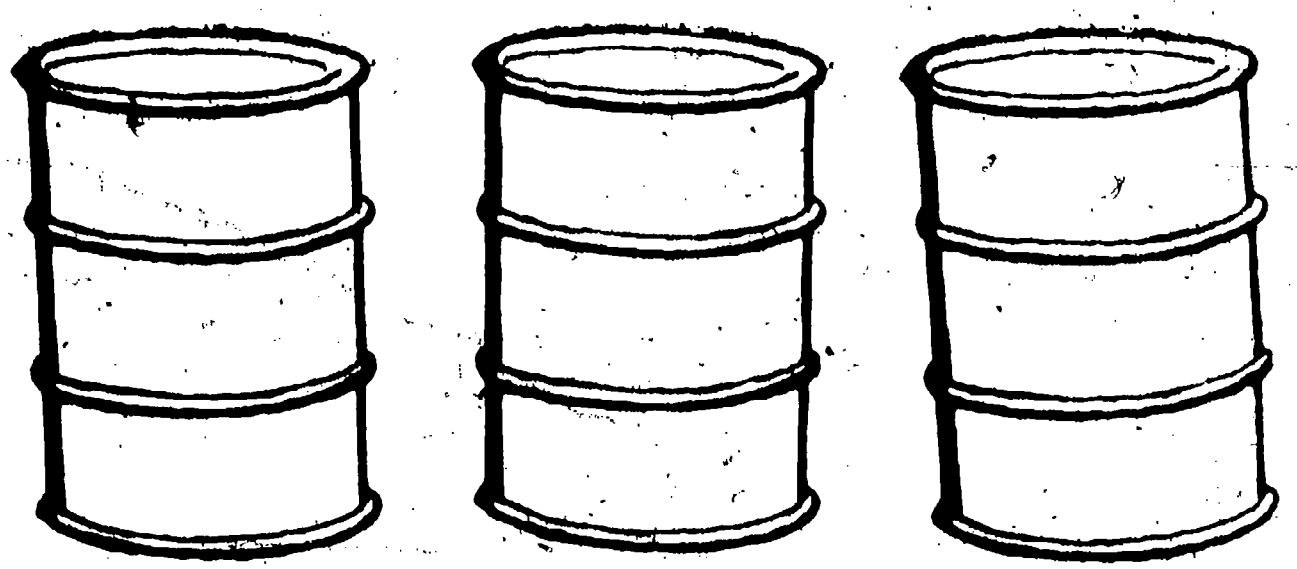

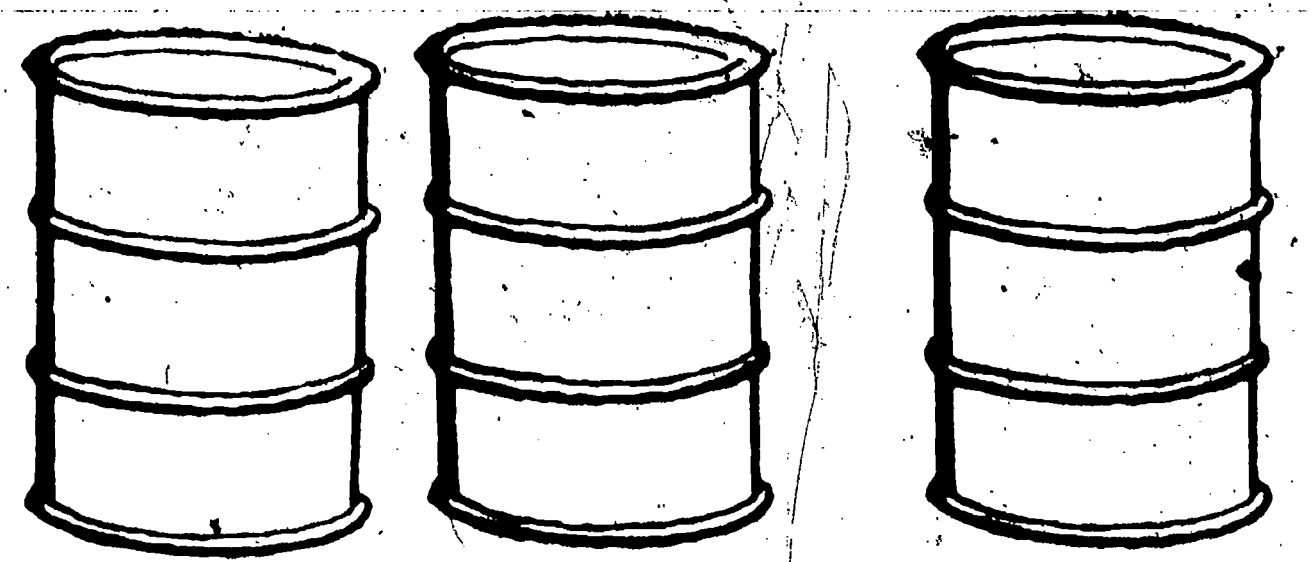

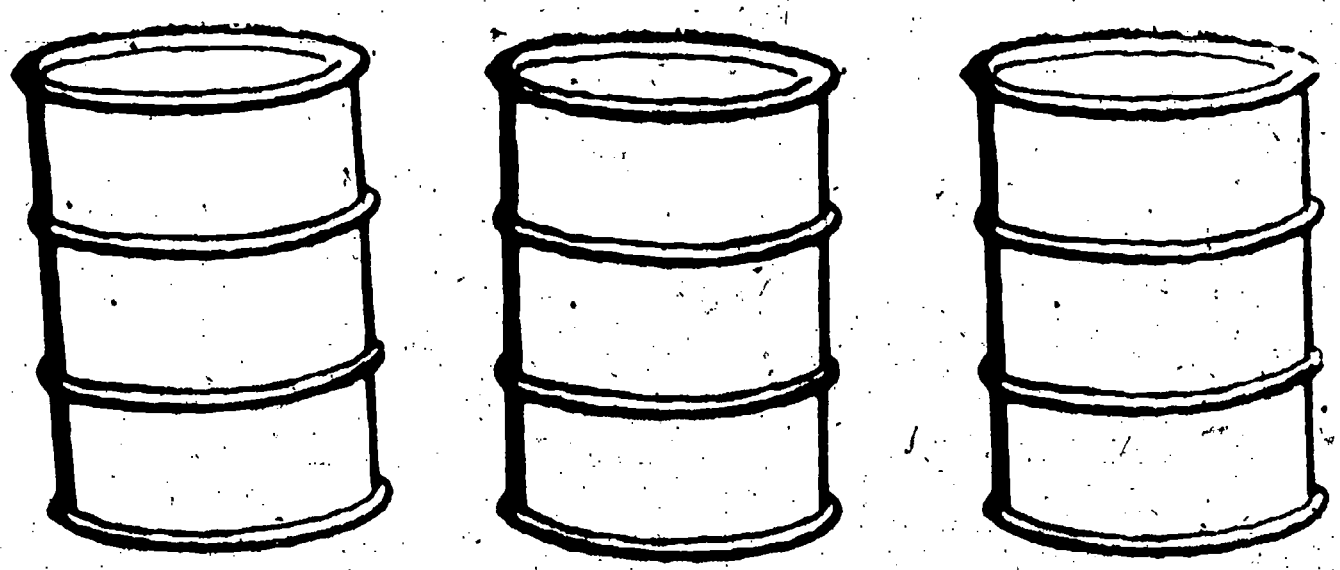

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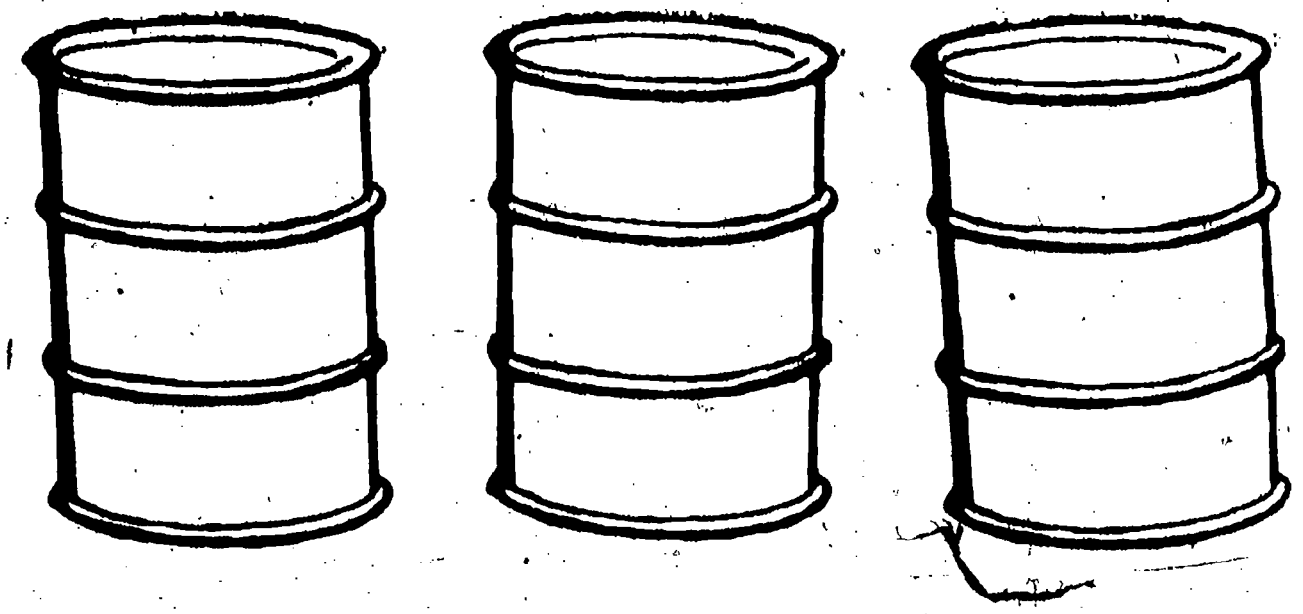

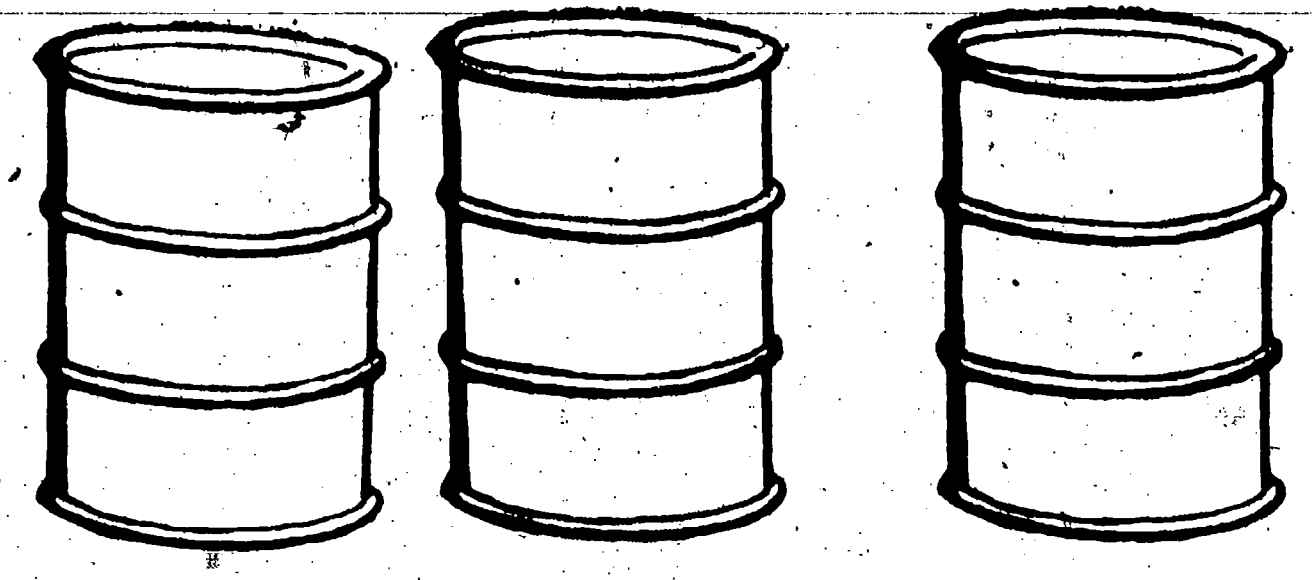

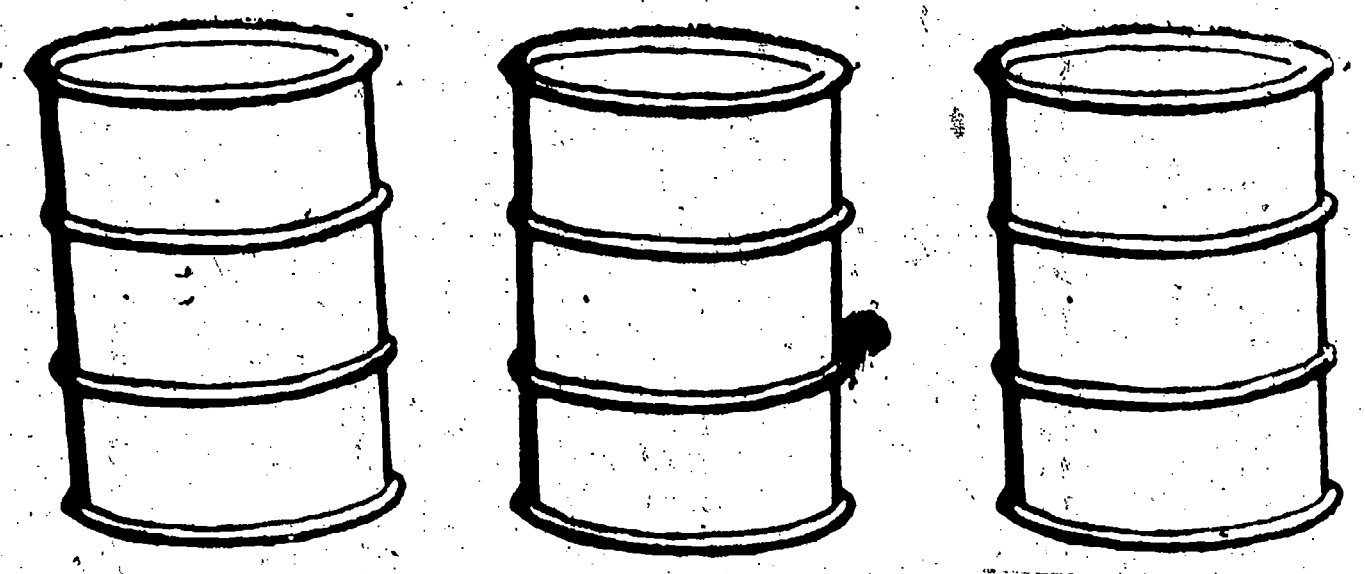

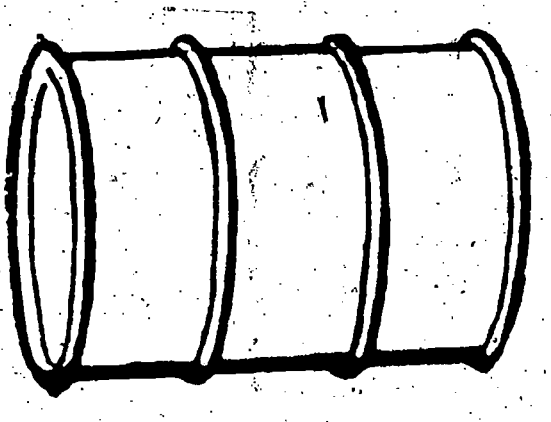

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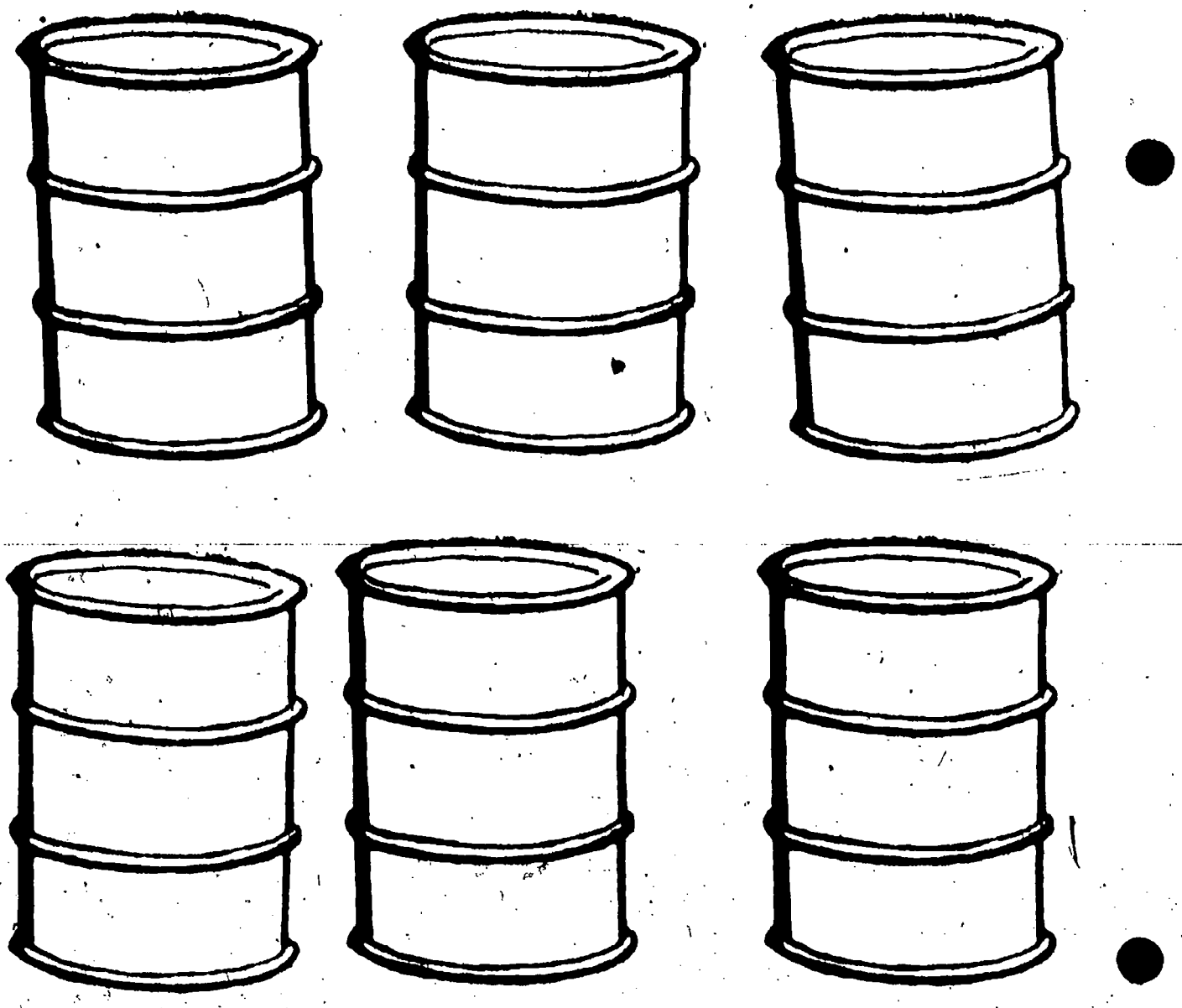

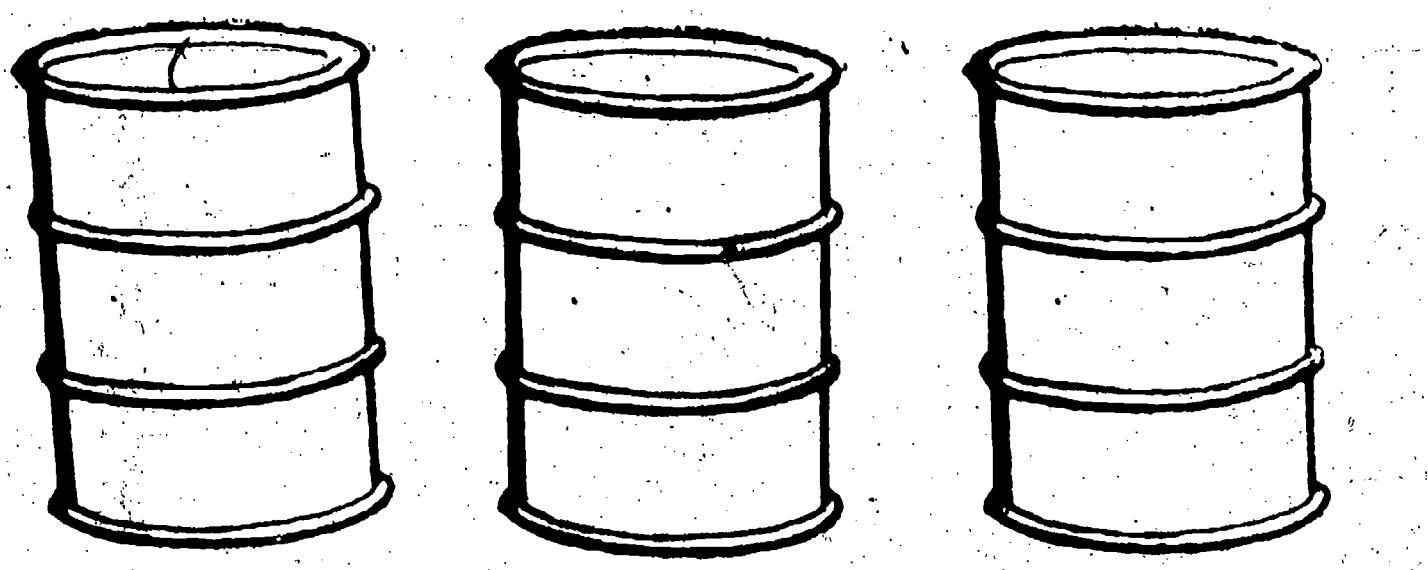

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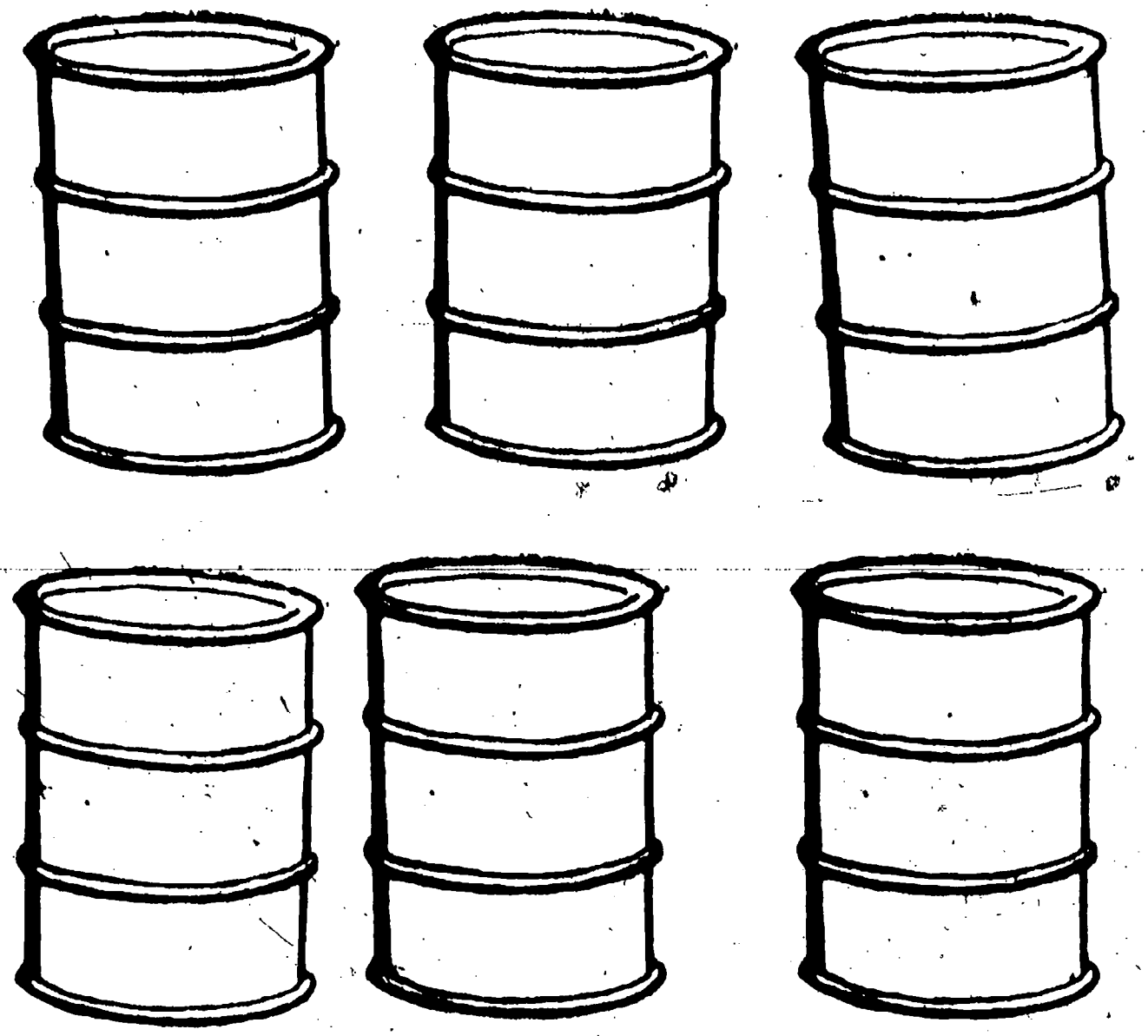

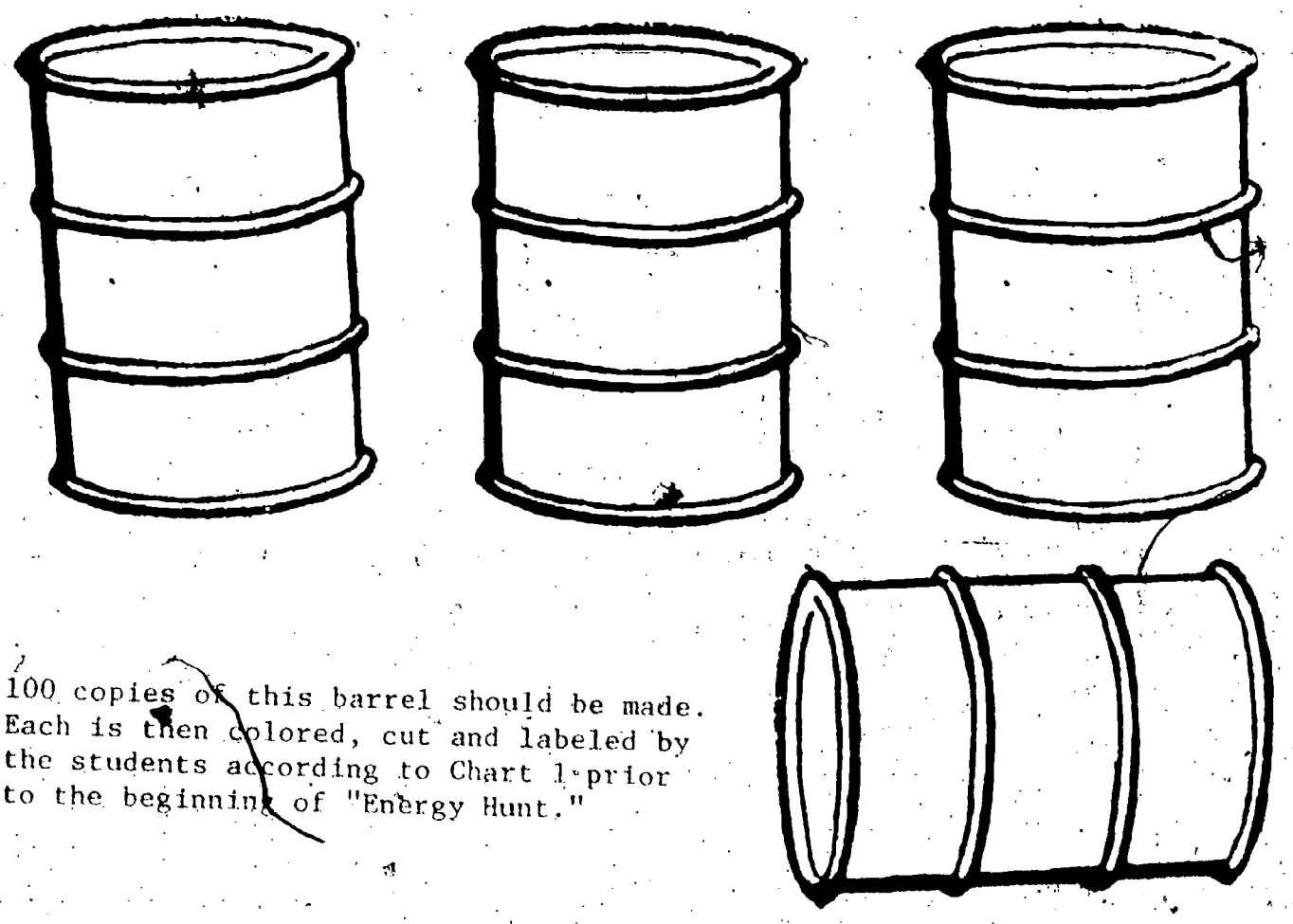

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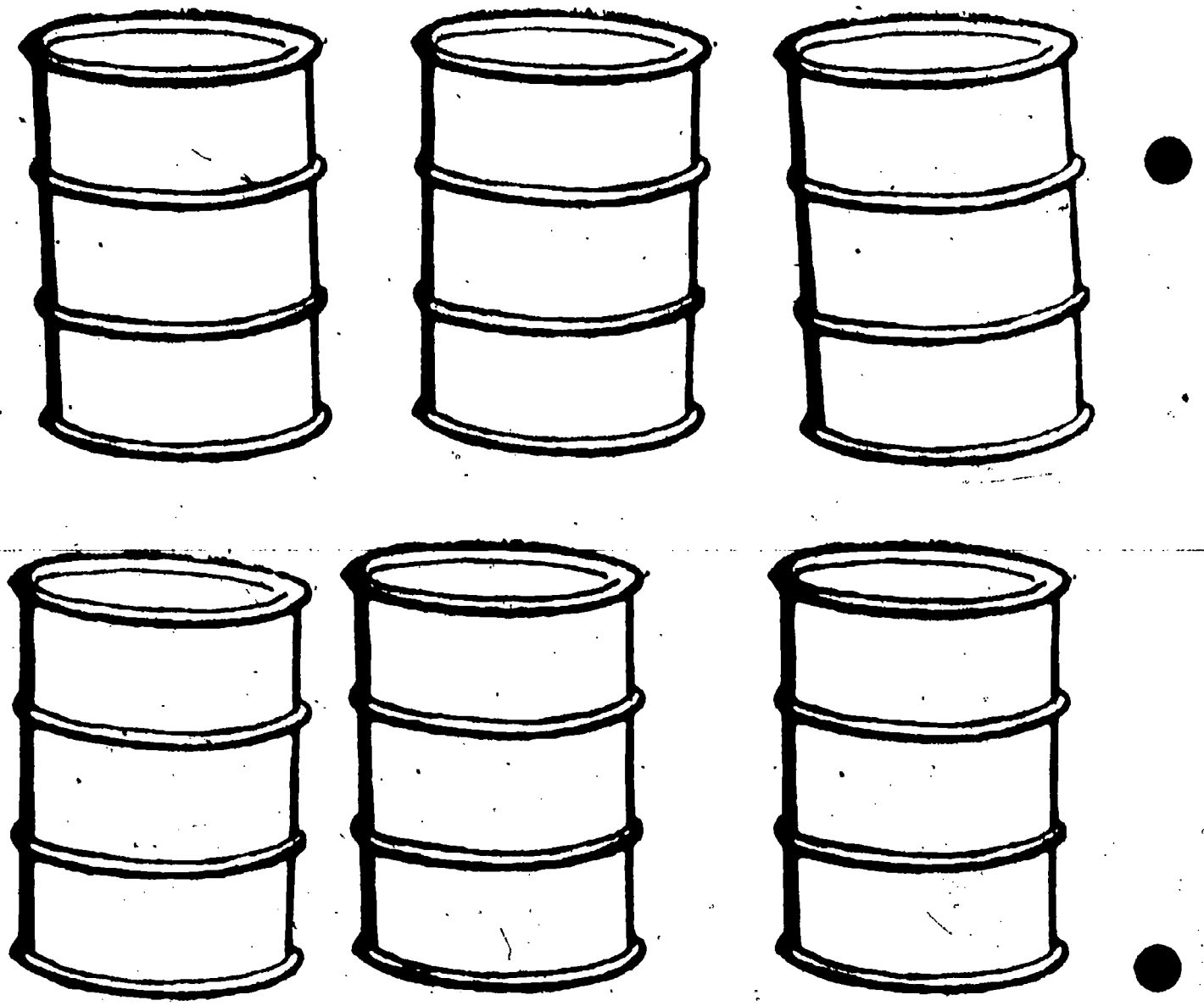

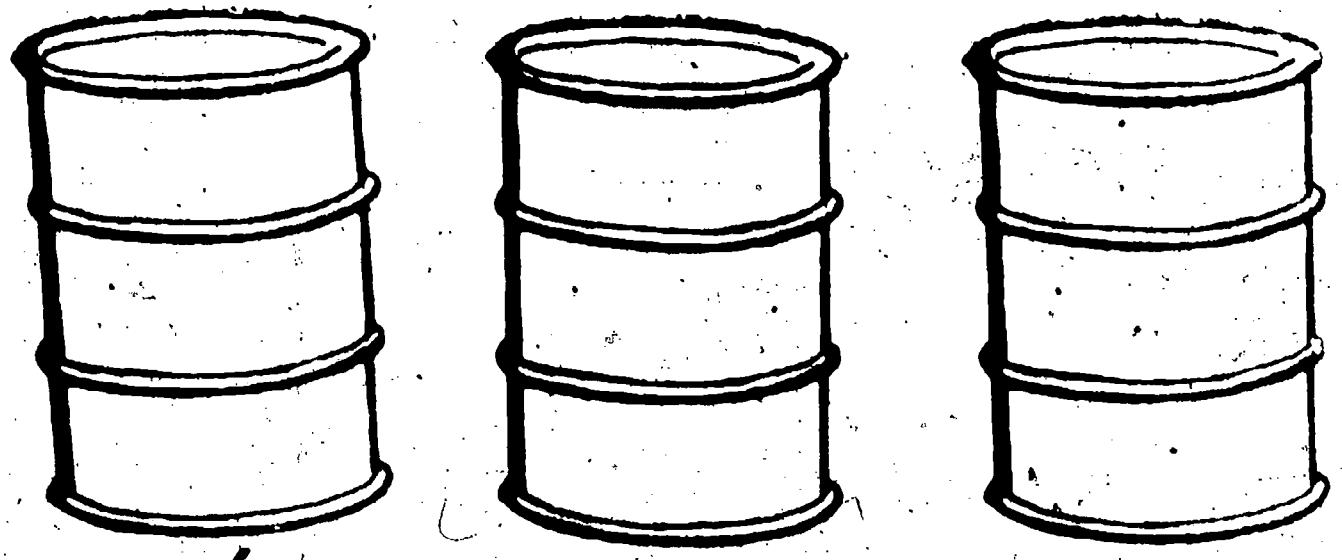

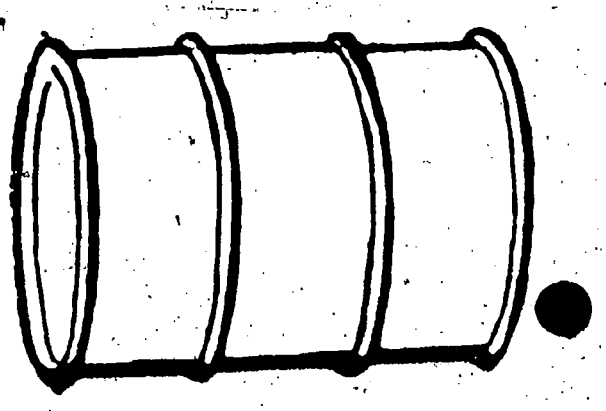

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CAN WE GET THERE FROM HERE?

by Nancy Corl

ACTIVITY: Can We Get There From Here? GRADE LEVEL: Eighth Grade

ACTIVITY DESCRIPTION:

Students will identify current bus and bicycle routes which lead from their homes to popular places in the community.

ENERGY CONCEPT:

When possible, people should use mass transit or bicycles as alternatives to energy-inefficient automobiles.

OBJECTIVES:

a. To identify popular places in the community that are safely accessible by bus or bicycle.

b. To identify whether these places provide adequate and secure storage for bicycles.

c. To discover who is responsible for decision-making regarding bus scheduling and routes.

d. To discover who determines the location and number of bicycle paths and/or cut-down sidewalks in their community.

CONTENT:

One of the significant ways in which energy conservation can be practiced by consumers is by limiting automobile use. It would be helpful to residents of a community if they knew what alternatives are available to them.

MATERIALS:

For each group of four: map of the city and environs; set of bus schedules and maps of routes; three, fine-pointed, different colored magic markers; 10-15 stickers or stars of one bright color.

STRATEGY:

Ask students how many of them have been driven to a movie, shopping mall, restaurant, library, etc. in the last week. Then ask how often the family car(s) has been used for similar reasons by other members of the

family--just a rough estimate. Remind them that 42% of the energy consumed by private citizens goes for automobile use.

Divide students into groups of about four each. Supply each group with a map of their city, a packet of bus schedules and routes, three different colored magic markers (like red, blue and black), and 10-15 colored stickers or stars.

Using the map, each group should mark an "X" on the places where they and their families spend a lot of time. Some of these places will be common to a number of families, but there should only be one "X" on the map per destination. Then, using another colored marker and the bus information, each group should draw the bus route(s) from each of their homes to the places they have identified with an "X", if such a route exists. Transfers are perfectly acceptable. Route(s) should be identified on the map by name and/or number. Ask whether they can get to their destinations on any day of the week and at any time of day or night. Then, the class should be asked to find out who makes decisions regarding bus routes and scheduling.

As an out-of-class assignment, each group should be asked to determine whether they can get from each of their homes to the destinations marked with an "X" by bicycle. The stipulation is that they must use cut-down sidewalks or bicycle paths on heavily traveled streets. If that isn't possible, the place is declared unreachable by bicycle and no route is marked on the map. But, any destinations found reachable primarily by sidewalks or paths should have their route marked with the third colored magic marker. As an additional activity, each destination that provides adequate and safe storage for bicycles, i.e. bicycle racks, lockers, etc. should be marked on the map with a colored sticker or star. Then the class should be asked to find out who determines the location and number of bicycle paths and/or cut-down sidewalks in their community.

At the conclusion of this mini-unit, each group should have a map marked with popular places for them and their families in the community. Possible bus and bicycle routes should also have been identified with different colored magic markers. Destinations with storage for bicycles should have been marked with a colored sticker or star. Students should have had a chance to discuss which group(s) in the community determine bus policy decisions. They should also know who is responsible for decisions concerning bicycle safety and policy in the community.

RELATED ACTIVITIES:

A. A group of students do a similar activity, using their school as the point of departure. Destinations could be named most often by their peers. This consolidated version could be hung in the school library or other display area for all students to see and use.

B. Students could write letters to businesses not currently providing bicycle storage, expressing their interest in such facilities.

C. Students could compare the amount of time it would take to reach each destination on their group map by bus, car or bicycle. This could be contrasted with the number of passenger miles per gallon for each mode of transportation (a measure of energy efficiency). A bus gets 500 passenger miles per gallon, a bicycle 1,000 passenger miles per gallon, a car only 30 passenger miles per gallon. Time vs. energy efficiency could then be a topic for discussion.*

A Caveat: The section of this mini-unit dealing with bicycles may require a permission slip from parents/guardians. If students are bicycling in the community as a result of a school project, a question of liability might be raised. Since each district is different, you might want to check with your school principal before assigning the bicycle section of this unit.

*Cook, Earl. 1976 "The Conservation of Free Energy." Man, Energy, Society. San Francisco: W.H. Freeman and Company. Pg. 136.

THE WEALTH OF WASTE

by Becky Moore

ACTIVITY: The Wealth of Waste (Grade 7 and 8)

ACTIVITY DESCRIPTION:

Students will record throw-away items in the home for a one-week period and then analyze the energy and resource costs of those items.

ENERGY CONCEPT:

All of us throw away unnecessary packaging materials or one-time use materials which took resources and energy to manufacture, and for which we paid. Are these really necessary? Can we recycle them? Can we use some of them more than once? Can we use some of them for other purposes?

OBJECTIVES:

Upon completion of this activity, students will be able to identify the major kinds of throw-away materials and identify the resource and energy implications of such limited use.

CONTENT:

Packaging materials and one-time use items cost resources and energy. We need to develop necessary packages made from renewable resources and for multiple use. Vocabulary related to these factors will be covered.

STRATEGY:

Part One - Introduce this activity by displaying and discussing some of the items from the checklist. Spend time familiarizing students with the various categories of the list and describing examples of these items, and how to use the list.

Part Two - Having an awareness of their own kinds and amounts of discarded materials, have students read and discuss the resource and energy costs' statistics. The accompanying questions for each category emphasize the implications of resources and energy use, and give an idea of electrical use possible from each pound of material discarded. An optional quiz is included.

MATERIALS: Examples of some throw-away items to stimulate discussion; checklist; follow-up exercise and optional quiz.

THE WEALTH OF WASTE

PART ONE DIRECTIONS: The pages that follow are a checklist of throw-away items in the home. Throw-away items are packages, containers, or products that we use one time and discard. Note that some packages will include two or three items in the checklist: for instance, some metal cans have a paper label and a plastic lid; or some packages containing food are made of a heavy paper box with a cellophane wrapper outside and a waxed paper liner. Whatever the size of the throw-away item, record on this checklist how many and what kinds of packages, containers, or products you and your family use one time and throw away during one week. Whenever something is thrown away, place a checkmark in the proper space.

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KITCHEN:

PAPER PRODUCTS:	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
Food box (cereal, etc.)							
Ice cream carton							
Candy or gum wrapper							
Food mix envelope							
Individual salt, sugar, etc.							
Pizza cardboard							
Egg carton (cardboard)							
Potato sack							
Charcoal or pet food bag							
Cardboard can w/metal ends							
Pop or beer pack							
Paper towel tube							
Utensil package							
Grocery bag							
Paper label on can/bottle							
Napkins							
Paper plates, bowls							
Paper cups, glasses							
Paper towel							
Waxed paper or liner							
Waxed boxes for refrig.							
Other							

KITCHEN:

	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
PLASTIC PRODUCTS;							
Beverage container							
Butter, margarine bowl							
Other plastic bowl							
Individual jelly/jam serv.							
Produce/vegetable tray							
Plastic lid							
Plastic straw							
Plastic glass							
Plastic knife, fork, spoon							
Pop/beer ring holder							
Garbage bag							
Freezer bag							
Sandwich bag							
Frozen food bag							
Cellophane bag							
Styrofoam egg carton							
Styrofoam label on bottle							
Styrofoam plates, bowls							
Styrofoam cups, glasses							
Styrofoam produce/veg. tray							
Styrofoam sandwich holder							
Dishwashing liquid bottle							
Other							

ITEM:	MON.	TUE.	WED.	THU.	FRI.	SAT.
METAL PRODUCTS;						
Aluminum foil						
Aluminum foil envelope						
Frozen food bowl						
Frozen food dinner tray						
Plastic foil pan						
Can (non-deposit)						
Other						
OTHER METAL PRODUCTS;						
Ham can						
Tin can						
Jar lid						
Bottle cap						
Other						
GLASS PRODUCTS;						
Jar						
Bottle (non-deposit)						
Other						

BATHROOM:

	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
PAPER PRODUCTS;							
Bath soap box							
Toothpaste box							
Toothbrush box							
Tissue box							
Toilet tissue roll							
Throw-away diapers							
Perfume/cologne box							
Drinking cup							
Wet Ones							
Cardboard sheet package							
Other boxes							
Other							
PLASTIC PRODUCTS;							
Shampoo tube or bottle							
Hair spray bottle							
Deodorant spray bottle							
Perfume/cologne bottle							
Dental floss container							
Drinking cup							
Pill/vitamin bottle							
Wet Ones container							
Deodorant stick							
Other plastic tube							
Other plastic bottle							
Cellophane wrap							
Other							

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BATHROOM:

	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
ALUMINUM PRODUCTS;							
Razor blade							
Other							
OTHER METAL PRODUCTS;							
Razor blade							
Razor cartridge							
Shave cream can							
Hair spray can							
Perfume/cologne can							
Toothpaste tube							
Other							
GLASS PRODUCTS;							
Perfume/cologne bottle							
Spray bottle							
Pill/vitamin bottle							
Cosmetic jar							
Other							

LAUND Y AND CLEANING SUPPLIES:

	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
PAPER PRODUCTS;							
Detergent box							
Cardboard can w/metal ends							
Softener sheets							
Other							
PLASTIC PRODUCTS;							
Bottle							
Other							
ALUMINUM PRODUCTS;							
Other							
OTHER METAL PRODUCTS;							
Spray can							
Other							
GLASS PRODUCTS;							
Bottle							
Other							

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[illegible] HOUSEHOLD:	SUN.	MON.	TUE.	WED.	THU.	[illegible]	[illegible]
[illegible] PRODUCTS;							
Newspaper							
Magazine							
Junk mail item							
Envelope mailed to you							
Gift wrap							
Gift wrap tube							
Sheet of paper							
Stationery							
Tags on new clothes							
Clothing wrapper							
Clothing box							
Yarn label							
Match box or book							
Cigarette pack							
Cigarette carton							
Light bulb wrapper							
Heavy paper box							
Cardboard, carton							
Other							

GENERAL HOUSEHOLD:	SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
PLASTIC PRODUCTS;							
Department store bag/sack							
Dry cleaning bag							
Leaf bag							
Scotch tape dispenser							
Air freshener holder							
Styrofoam packing filler							
Styrofoam spool							
Other							
ALUMINUM PRODUCTS;							
Other							
OTHER METAL PRODUCTS;							
Charcoal fuel can							
Insect spray can							
Battery							
Other							
GLASS PRODUCTS;							
Light bulb							
Other							

THE WEALTH OF WASTE

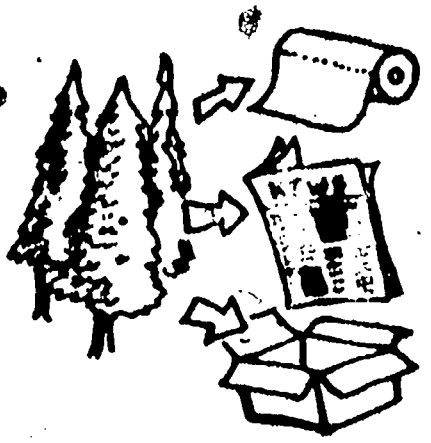
It has been determined that Americans create 4.3 billion tons of solid waste every year. This is a daily rate of 12,000,000 tons. Individually, each of us is responsible for over twenty tons of solid waste each year; most of this is an indirect waste (agricultural wastes, 20,000 pounds; mining and mineral wastes, 17,000 pounds; and industrial wastes, 1,100 pounds). However, all of us are directly responsible for some solid waste; on an average, for one year --

Paper and paper products	580 pounds
Metal cans	300 pounds
Bottles and jars	280 pounds
Plastics	38 pounds
Rubber	20 pounds
Metal squeeze tubes	6 pounds.

These residential wastes are only about six percent of the total; but to collect only two-thirds of them accounts for much of the $9 billion spent every year on urban waste collection and disposal. There are two reasons we need to be concerned about solid waste; -1- the world supply of mineral resources is rapidly decreasing; and -2- the costs of waste disposal are prohibitively high, and rising. These two reasons justify a reduction in packaging and an abandonment of planned obsolescence (making a product or package for one-time or short-term use).

Note: The statistical information in these discussions is from G. Tyler Miller, Jr., Living in the Environment: Concepts, Problems, and Alternatives, Wadsworth Publishing Company, Inc., Belmont, California, 1975; pages 153, 207, E57-E67.

PAPER PRODUCTS



Paper products are made from the wood pulp of trees and trees are a renewable resource when properly managed. Each of us uses an average of 580 pounds of paper every year. A Sunday edition of the New York Times consumes 150 acres of forest. If we recycle a thirty-six inch stack of newspapers, we will save one tree. If we can increase paper recycling from 20% to 30% we will save an additional 300 million trees every year. The advantages of recycling paper include less pollution of air and water, less use of water and electricity than in making new paper, and a saving of trees. The forests are important to us as a source of paper pulp, firewood, and building materials; and in Nature, they act as watersheds to absorb, hold, and release water, they preserve soil, they affect the climate by producing oxygen and absorbing heat, they provide plant and animal habitats, and they absorb some air and noise pollution. Aesthetically, trees are a source of recreation and beauty.

_____ 1. From what resource is paper made?

_____ 2. What kind of resource is that?

_____ 3. How many pounds of paper will an average family of four use in one year?

_____ 4. In a year, how many acres of forest will the Sunday editions of the New York Times consume?

_____ 5. List three advantages of recycling paper.

_____

_____

_____ 6. Man depends on forests as a source of what three materials?

_____

_____

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7. List five important environmental functions of forests.

PLASTIC PRODUCTS

Plastic products are petrochemicals -- they are made from petroleum. Petroleum (oil) is a nonrenewable resource; it is finite; we can use it one time. The United States produces oil, but we also import much of the oil we use. Oil prices are high and will continue to rise. Because plastic products are made from a nonrenewable resource, and because they are slow to degrade (a typical discarded plastic bag will not be fully degraded for nearly 240 years), we need to reduce or eliminate the use of plastic for one-time use.

_____ 1. From what resource are plastics made?

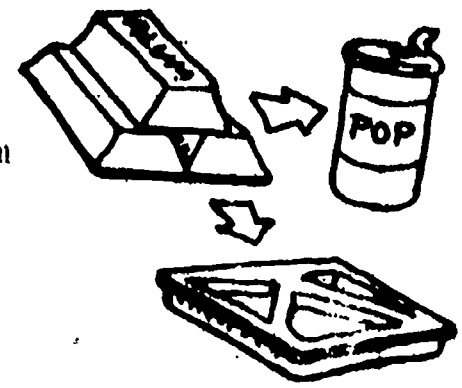
_____ 2. What kind of resource is that?

_____ 3. Will a discarded plastic bag degrade in your lifetime?

_____ hours 4. To produce a pound of plastic requires 727 watt hours of electrical energy: how long can you burn a 100 watt light bulb by using the same amount of energy it took to make a pound of plastic?

_____ 5. You are responsible for 38 pounds of plastic waste every year: how many watt hours of electrical energy did it take to make those 38 pounds?

ALUMINUM PRODUCTS



Aluminum is smelted from aluminum oxide from the mineral called bauxite; as a mineral resource, it is nonrenewable. We have been careless with this resource; the familiar throw-away aluminum can is an inefficient use of it. Aluminum is worth $200 a ton; we have discarded $14 billion worth of aluminum cans in recent years. Carelessly tossed into the environment, the aluminum can will not break down into aluminum oxide dust for about five hundred years. Aluminum production consumes about five percent of the electricity used in the United States every year. Development of aluminum recycling has increased the energy efficiency of aluminum production; it can save up to ninty-five percent of the energy used to make aluminum from bauxite. Twenty-three twelve-ounce aluminum cans equal one pound of aluminum; call 1-800-223-6830 to learn of the nearest aluminum can recycling center. They will pay you for recyclable aluminum items you deliver.

_____ 1. From what mineral is aluminum made?

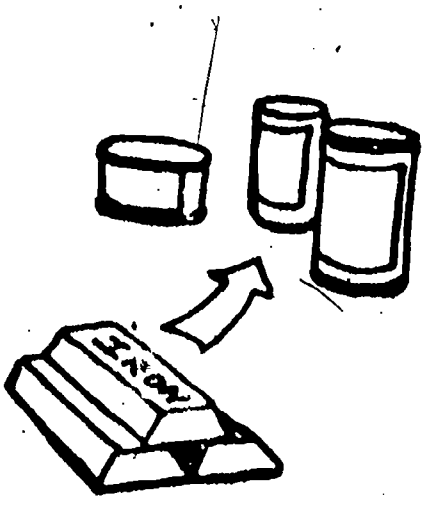
_____ 2. What kind of resource is that?

_____ 3. Why is recycling such an advantage in the aluminum industry?

_____ hours 4. To produce a pound of aluminum requires 34878 watt hours of electrical energy: how long can you burn a 100 watt light bulb by using the same amount of energy it took to make a pound of aluminum?

_____ 5. If you burn the light bulb ten hours a day, how many days will it burn from that amount of energy?

OTHER METAL PRODUCTS



The "tin" can is of primary concern for this exercise. Actually the "tin" can is a steel can with a thin coating of tin. Steel manufacture requires the nonrenewable resources of iron ore and coal, in part. If iron costs $13 a ton, we are discarding $74 million worth of iron each year by throwing away "tin" cans. "Tin" cans we discard will rust away to iron oxide in about one hundred years. By not salvaging them, we are depleting valuable metal and energy resources, and creating more air, water, and land pollution.

_____ 1. What is a "tin" can made of primarily?

_____ 2. From what two resources is that made, in part?

_____ 3. What kind of resources are they?

_____ hours 4. To produce a pound of steel requires 9832 watt hours of electrical energy; how long can you burn a 100 watt light bulb by using the same amount of energy it took to make a pound of steel?

_____ 5. If you burn the light bulb ten hours a day, how many days will it burn from that amount of energy?

GLASS PRODUCTS

Glass products are made from sands which are very abundant; glass sand and soda ash are melted in a furnace requiring much heat. Glass products are recyclable or reusable. Recycling throw-away glass (crushing and remelting it) demands more energy than that of a returnable glass bottle. If the twelve billion throw-away soft drink and beer bottles used in 1970 had been returned, it would have saved us enough electricity to supply about 6.5 million typical American homes for one year. The throw-away glass bottle will require at least a million years to break down into sand-sized particles. Returnable bottles have an energy requirement advantage over nonreturnable (throw-away) bottles. The returnable glass container may be reused (refilled) fourteen to twenty times before it is broken; and it will require less energy than production of nonreturnables.

_____ 1. From what is glass made?

_____ 2. Name the two categories of glass products,

_____

_____ 3. Which of them is more energy efficient?

_____ hours 4. To produce a pound of glass requires 806 watt hours of electrical energy: how long can you burn a 100 watt light bulb by using the same amount of energy it took to make a pound of glass?

_____ hours 5. You are responsible for 280 pounds of glass waste every year: how long will a 100 watt light bulb burn, by using that same amount of energy it took to produce those 280 pounds of glass?

_____ 6. If you burn the light bulb ten hours a day, how many days will it burn from that amount of energy?

THE WEALTH OF WASTE - QUIZ

1. Give two reasons we must be concerned about solid waste (throw-away items).

   a-_____

   b-_____

2. What does "planned obsolescence" mean?

   _____

_____ 3. What resource can be saved if we recycle paper products?

_____ 4. What resource can be saved if we recycle plastic products?

_____ 5. In terms of energy used, what is the importance of aluminum recycling?

_____ 6. Steel manufacutring uses what two resources?

_____ 7. From what resource is glass made?

8. What is the difference between recycling glass and reusing glass?

_____ 9. Which is more efficient in terms of energy use -- the recycled glass container or the reused glass container?

_____ 10. Which kind of throw-away item takes the most energy to produce per pound and will therefore burn your 100 watt light bulb for the longest time?

_____ 11. Name three nonrenewable resources.

_____

_____

_____ 12. Name a renewable resource.

TEACHER REFERENCES

ANSWERS - PART TWO

PAPER PRODUCTS

1. trees
2. renewable
3. 2320 pounds
4. 7800 acres
5. less air and water pollution
   less use of water and electricity
   saves trees
6. paper pulp
   firewood
   building materials
7. watersheds
   preserves soil
   affect climates (produce oxygen and absorb heat)
   provide plant and animal habitats
   absorb air and noise pollution

PLASTIC PRODUCTS

1. petroleum
2. nonrenewable
3. no
4. 7.27 hours
5. 27626 watt hours

ALUMINUM PRODUCTS

1. bauxite
2. nonrenewable
3. more energy efficient
4. 348.78 hours
5. 34.878 days

ANSWERS - QUIZ

1. a - the world supply of mineral resources is rapidly decreasing.
   b - the costs of waste disposal are prohibitively high, and rising.

2. making a product or package for one-time or short-term use.

3. trees

4. oil

5. more energy efficient

6. iron ore
   coal

7. sand

8. recycled glass is crushed and remelted;
   reused glass is refilled.

9. reused

10. aluminum

11. oil
    bauxite
    iron ore
    coal

12. trees

ENERGY EQUIVALENTS OF MATERIALS AND LABOR

Material	Energy Eq. BTU/lb.	Ref.	Note
Copper	3372	1	1
Aluminum	119040	1	1
Steel	33728	1	2
Glass	2750	2	-
Plastic	2480	1	-
Insulation	2750	-	3
Concrete	418	1, 3	-
Labor	Energy Eq. BTU/man-hr.	Ref	Note
Man-hours	1271	1	-

References:

1. Roller, W. I., Kenner, H. M., Kline, R. D., Mederski, H. J., and Curry, R. D., "Grown Organic Matter as a Fuel Raw Material Resource," Ohio Agricultural Research and Development Center, NASA CR-2608, October, 1975.

2. Owens-Illinois, personal communication.

3. Moore and Moore, "Materials of Engineering," McGraw-Hill, Inc., page 225.

Notes:

1. Includes casting and forging.
2. Includes fabrication and castings.
3. Assumed to equivalent to glass.

NOTE - BTUs were converted to watt hours by dividing the number of BTUs required to produce one pound of the product type by a conversion factor of 3.413 (3.413 BTUs equals one watt hour).

Cook, Earl, Man, Energy, and Society, W. H. Freeman and Co., San Francisco, California, 1976, page 13.

COMPARISON OF ENERGY REQUIREMENTS
FOR RETURNABLE AND NONRETURNABLE CONTAINERS

TYPE OF SYSTEM	RATE OF ENERGY WASTED COMPARED TO RETURNABLE BOTTLE
Returnable glass bottle without recycling (national average of 15 refills)	1
Returnable glass bottle recycled after 15 refills	1.04
Throwaway steel-tin can without recycling	2.68
Throwaway glass bottle without recycling	3.00
Throwaway glass bottle with recycling	3.23
Throwaway all-aluminum can without recycling	3.60

Source: G. Tyler Miller, Jr., Living in the Environment: Concepts, Problems, and Alternatives, Wadsworth Publishing Company, Inc., Belmont, California, 1975, page E-65.

BIBLIOGRAPHY

Canby, Thomas Y., "Aluminum, the Magic Metal," National Geographic, Volume 154, No. 2, August, 1978, pages 186-211.

Cook, Earl, Man, Energy, Society, W. H. Freeman and Co., San Francisco, California, 1976.

Miller, G. Tyler, Jr., Living in the Environment: Concepts, Problems, and Alternatives, Wadsworth Publishing Co., Inc., Belmont, California, 1975.