DOCUMENT RESUME

ED 134 415 SE 021 482

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TITLE Our Environment - A Collection of Lessons.
INSTITUTION Council on the Environment of New York City, N.Y.
PUB DATE 73
NOTE 72p.
AVAILABLE FROM Council on the Environment of New York City, 51 Chambers Street, New York, New York 10007 ($1.50)

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS *Elementary Education; *Elementary School Science; *Environment; *Environmental Education; *Instructional Materials; *Teaching Guides; Urban Areas

ABSTRACT

The lessons in this publication present a concrete approach to the teaching of environmental science for grades 3 through 8. The ideas presented are geared for use in an urban setting. The material is structured so that it can be used as an entire unit or parts of it can be adapted for use with on-going classroom activities. Twenty-seven lessons are included. Each activity includes suggestions for motivation, procedures to follow, questions to raise, and answers to many of the questions. Sketches for overhead transparencies are included for many of the lessons. (RH)

Council on the Environment
of New York City

INTRODUCTION

Environmental Studies are increasingly being stressed in school curricula. The Council on the Environment of New York City, aware of the need for teaching aids, has prepared a collection of lesson plans for the teacher who wants to incorporate environmental studies into the everyday classroom routine. These lessons present a concrete approach to the teaching of environmental science for grades 3 through 8. The ideas presented in "Our Environment" are geared for use in an urban setting. "Our Environment" - A Collection of Lessons contains both small units and individual lessons. This material is structured so that it can be used as an entire unit or, alternatively, parts of it can be adapted for use with on-going classroom activities.

The Council on the Environment of New York City is a broadly-based citizens' group, set up within the Office of the Mayor of New York City, and is funded by voluntary contributions from individuals, organizations, and corporations.

The art work in this publication was prepared by Raymond Brilli.

$1.50

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LESSON 1

AIM: What is my Environment?

MOTIVATION: Write in your notebook 5 things which are part of your environment.

DEVELOPMENT:

1) Have students read their answers to the motivation question and list them on the board.

   Examples: (there are hundreds of examples)

school	cars	animals (dogs, cats, birds)
people	buses	houses
playground	trains	sunlight
streets	trees	clouds
sky	air	grass

2) If all these things we have listed are part of our environment, how could we define the word environment?

3) Environment - all conditions which influence and affect an organism (any living animal or plant).

4) If we look out the window, can we see anything which is not part of our environment? (No) Why?

SUMMARY:

1) Class could draw a picture of its environment.

2) Class could be asked to list 10 more things in its environment.

LESSON 2

AIM: What kind of things make my environment unclean?

MOTIVATION: Diagram - Lesson 2 (Duplicate for students or use as transparency for overhead projector.)

DEVELOPMENT:

1) Ask class to identify all things in the picture which make the environment unclean. List these on board.

2) The black smoke coming out of chimneys is called? (air pollution)

3) What do we call paper, glass, and cans which are on the sidewalk and street? (litter)

4) The garbage in the garbage cans is called Solid Waste (a major problem).

5) The smoke coming out of the car and bus would contribute to what? (air pollution)

6) Does the noise of the car horn make our environment unclean? How? (noise pollution)

7) What is pollution? (to make unclean or unpure)

SUMMARY:

What kinds of pollution affect us?


RAG FACTORY
MEOWWW
DELICATESSEN
Pepsi
Pepsi
TRUCKING COMPANY
BEEP BEEP

LESSON 3

AIM: What is Solid Waste?

MOTIVATION: Display empty aluminum cans, bottles, boxes, newspapers and magazines, plastic bottles, etc.

DEVELOPMENT:

1) What is usually done with all these things (referring to "garbage" on teacher's desk)?

2) This "garbage" as you call it is also called Solid Waste.

   DEFINITION SOLID WASTE -- anything that is solid and wasted.

3) Does all this material have to become garbage?

4) What can be done instead of throwing it away? (recycle some of it)

5) How many of the items I have on my desk could be recycled?

   a) Aluminum cans
   b) Glass
   c) Newspaper

6) Why should we be concerned with recycling?

   a) To cut down on the amount of material wasted; used only once.
   b) So there will be enough aluminum, glass, paper, etc. in the future when we need them.

SUMMARY:

Does everything we now throw away have to be garbage?

LESSON 4

AIM: How does air pollution affect you?

MOTIVATION: Why is air important to us?

DEVELOPMENT:

1) We need air in order to live. (We breathe air to get oxygen.)

2) What does the word "pollution" mean?

3) What does air pollution mean?

4) What things make our air dirty?

   a) Car exhaust (91 million tons of pollutants/year)
   b) Smoke from factories (76 million tons of pollutants/year)
   c) Dust & other particles (29 million tons of pollutants/year)
   d) Etc.

5) What harm can air pollution do?

   a) Poisonous gases from cars, like carbon monoxide, can kill us or make us sick.

   b) Other gases from factories and power plants, like sulphur dioxide and nitrogen dioxide, can irritate our eyes, nose, and damage our lungs.

   c) Small particles of dust, ash, and smoke can soil clothing, dirty window sills and homes.

   d) Plants and animals are also affected, like us, by air pollution.

6) Can air pollution be reduced? (Yes) How?

   a) Cars should be tuned regularly and run on low lead gas whenever possible.

   b) Factories and power plants could remove pollutants from smoke with the proper equipment.

SUMMARY: What is air pollution?

LESSON 5

AIM: Noise pollution.

MOTIVATION: Hit a ruler on a desk, making a very loud noise.

DEVELOPMENT:

1) What or how did you feel when you heard this noise?

   a) Did you feel your heart rate speed up?

   b) Did you feel tense? Ready for something to happen?

2) How do you feel when a car blows its horn & surprises you?

3) Did you ever hear a very loud noise which hurt your ears? What was it? (list responses on board)

4) Did you know that very loud noises can make you go deaf? The increased tension caused by noise is not healthy.

5) What does the word "pollution" mean?

6) Does noise make our environment dirty? How?

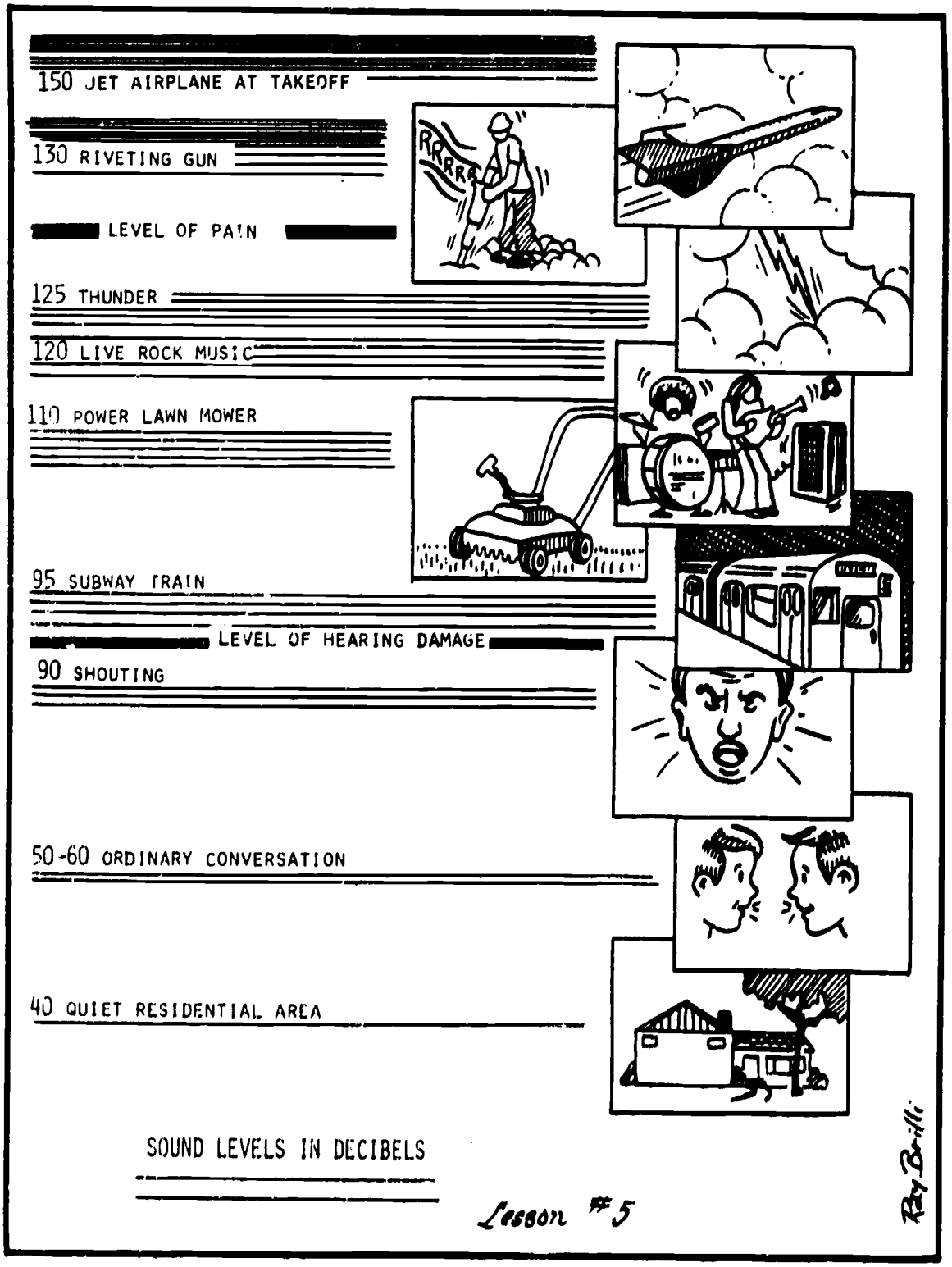
   (We could call noise a form of pollution, because if it is loud enough, it makes our environment unsafe for us to live in.)

7) Let's look at this sound level chart and compare the loudness of different sounds.

SUMMARY: 1) What are some types of pollution we have talked about?

2) What do all forms of pollution have in common? (They make our environment dirty.)

3) How does noise pollution harm us?


150 JET AIRPLANE AT TAKEOFF
130 RIVETING GUN
RRRRR
LEVEL OF PAIN
125 THUNDER
120 LIVE ROCK MUSIC
110 POWER LAWN MOWER
95 SUBWAY TRAIN
LEVEL OF HEARING DAMAGE
90 SHOUTING
50-60 ORDINARY CONVERSATION
40 QUIET RESIDENTIAL AREA
SOUND LEVELS IN DECIBELS
Lesson #5
Ray Brilli

LESSON 6

AIM: What is litter?

MOTIVATION: Ask the class to look on the floor and describe what it sees.

DEVELOPMENT:

1) How did all this "stuff" get onto the floor?

2) What is garbage which doesn't end up in a garbage can called? (litter)

3) How many different kinds of litter can we find on the floor of our classroom?

4) Can you give me some examples of litter found on the street?

5) Who puts litter on the streets?

6) How can people eliminate litter?

7) What can you do about the problem of litter on the streets?

SUMMARY:

1) What is litter?

2) Where does litter come from?

HOMEWORK:

1) Make a list of all the different kinds of litter you see on the way home.

2) Bring in one exampl of litter you find on the way to school tomorrow. (Teacher can make a large experience chart showing the different kinds of litter.)

LESSON 7

AIM: Problems in our neighborhood - we are doing our part.

MOTIVATION: Assign students (several weeks in advance) to take pictures of local environmental problems, such as abandoned cars, rubbish filled lots, smoke stacks issuing forth black smoke, parks which need cleaning or are in total disrepair, etc.

DEVELOPMENT:

When the pictures have been developed (use slides or prints- to show prints to the class use an opaque projector), show each of the pictures and discuss where the problem is (possibly mark the trouble spots on a map of the area); what the problem is; and a possible solution to the problem (one solution is to have students write letters to various officials enlisting their aid in helping to correct the problem).

Put the pictures on the bulletin board with copies of letters, written by the students, to the appropriate agencies or officials who could help remedy the situation. The replies received can be also placed on the bulletin board along with follow-up pictures if appropriate action has occurred.

LESSON 8

AIM: Our changing environment.

MOTIVATION: Distribute picture (Lesson 8) and ask the students to describe (or write) what they observe in each picture.

DEVELOPMENT:

1) Is the land shown in picture #1 the same piece of land as in picture #5? How do you know?

2) What has happened to the tree in the different pictures?

3) Does anyone know what "erosion" means?

4) Which picture shows the first evidence of erosion?

5) In how many different ways has this land been used?

6) In which diagram would you expect to find the first evidence of pollution?

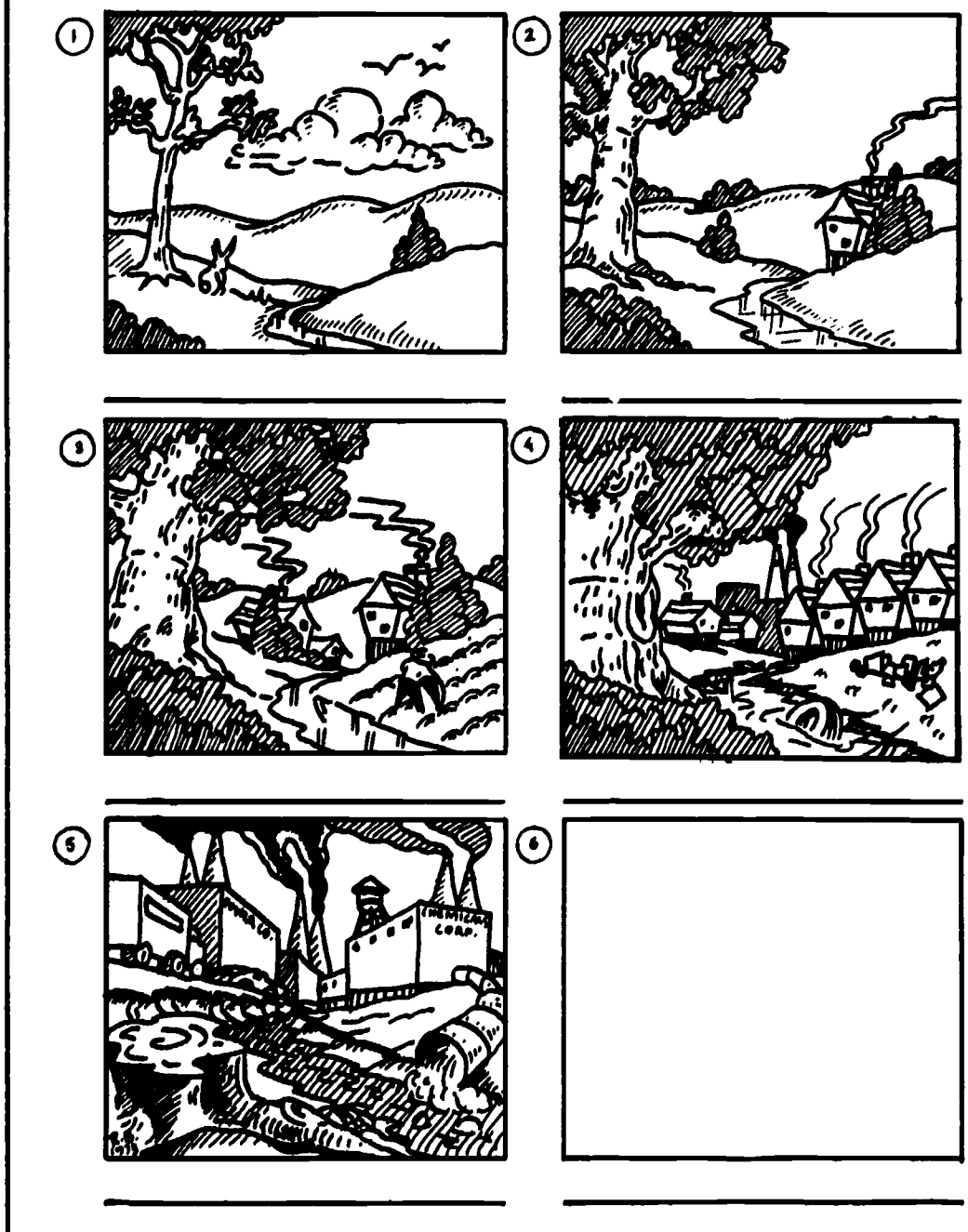
7) What is pollution?

8) Where does pollution come from?

9) How many kinds of pollution can you find in these pictures?

SUMMARY:

Use the empty box to draw (or write) what you think this piece of land should look like.



Lesson #8

LESSON 9

AIM: Transportation

MOTIVATION: Take class to the intersection of a busy street near the school and have them count how many cars go by in 3 minutes.

DEVELOPMENT:

1) After the students have taken counts for 3 3-minute periods, have them count for 3 3-minute periods the number of people in each car.

2) If there are buses going past the corner on which you are standing, students can try to count how many people a bus holds. (During rush hours a bus accommodates about 90 people.)

3) Return to the classroom and help students figure out how many cars use that street every hour (number of cars for 3-minute period x 20) and take the average for the 3 counts.

4) Have students figure out the average number of people per car.

5) Have students compare the number of cars needed to transport 200 people vs. the number of buses needed to transport 200 people.

SUMMARY:

Ask students what is the more effective way of moving large numbers of people causing the least pollution. Why did they give the answer they did?

LESSON 10

AIM: How does pollution affect me?

MOTIVATION: Exhibit to the class a diagram or transparency of a human figure. Ask class - what kinds of pollution affect this person?

DEVELOPMENT:

1) List on the board all the kinds of pollution which the class mentions.

2) What parts of this person's body are affected by air pollution? (Draw arrows to various parts and list symptoms.)

   a) Eyes - made red and irritated by air pollutants.

   b) Lungs - particles become trapped and breathing is harder.

   c) Throat - made raw from air pollutants.

   d) Head - headaches and dizziness from air pollutants.

3) What part of our body can be hurt by noise pollution?
   a) Ears - if noise is loud enough, serious damage to ears and loss of hearing can occur.

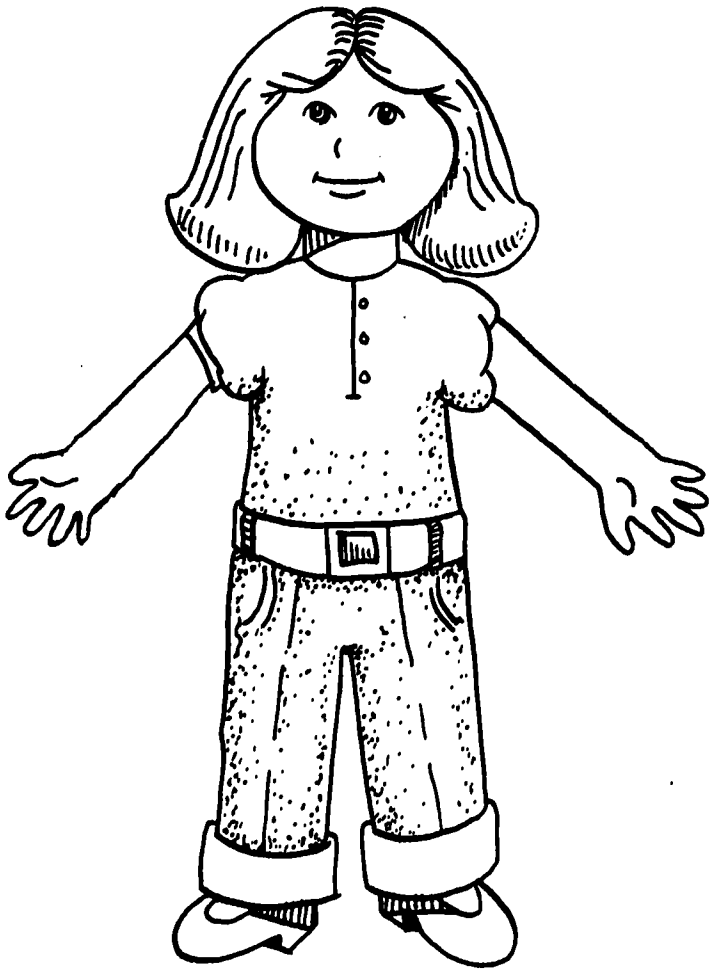
4) How does water pollution affect us?

   a) Beaches are closed.
   b) Rivers like East River and Harlem River cannot be used for swimming.
   c) We can get sick from drinking polluted water.

5) The cost of pollution is usually passed on to the public. How does this affect us? (Costs us (our parents) money.)

SUMMARY: 1) What kinds of pollution affect you?

2) Why is pollution dangerous to you?



Ray Brilli

Lesson #10

LESSON 11

AIM: Man and the Environment.

MOTIVATION: Distribute copies of "Where Would You Like To Live?" diagram.

DEVELOPMENT:

1) Look at the 2 pictures. Which neighborhood would you like to live in? Why?

2) Would you like to live in the neighborhood shown in the top picture? What don't you like about this neighborhood?

3) How many kinds of pollution are shown in these pictures? In which neighborhood is more pollution found?

4) What caused the differences between the 2 neighborhoods?

5. What is the difference between the 2 neighborhoods? (are they the same neighborhood?)

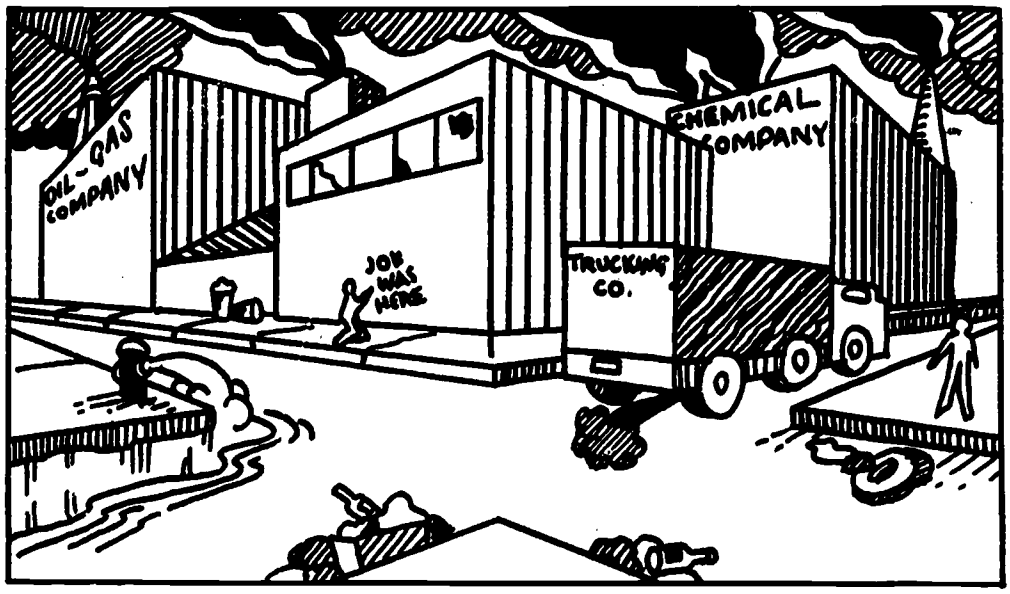
SUMMARY:

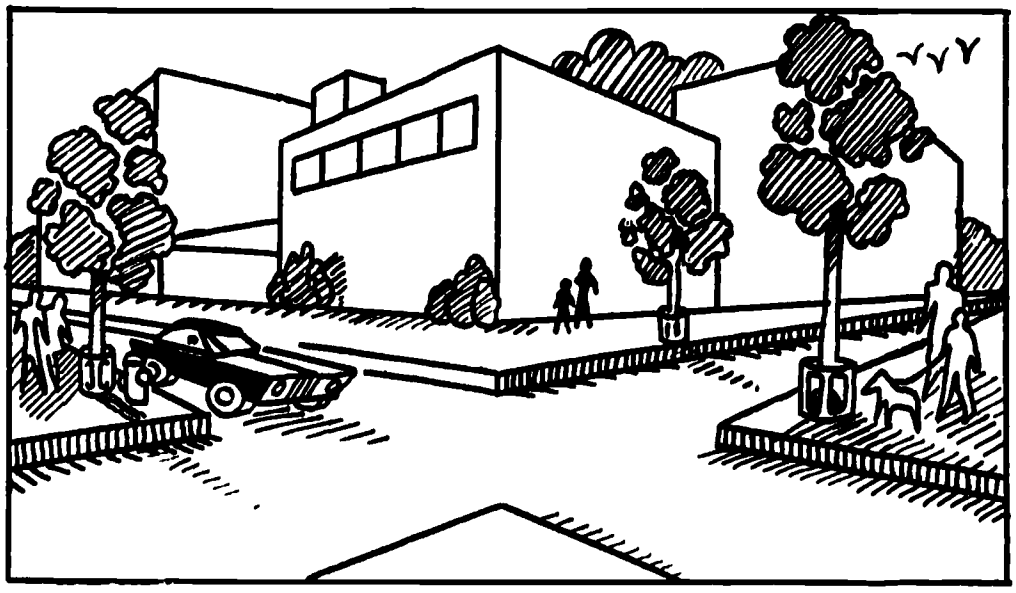
1) Who causes some of the environmental problems?

2) Who has to worry about environmental problems?

3) What would you suggest be done to the neighborhood in the top picture?

"Where Would You Like To Live?"





Lesson #11

LESSON 12

AIM: A walk to observe Environmental Problems around our school.

MOTIVATION: Class will go on a walk in the neighborhood of the school.

DEVELOPMENT:

1) Instruct the class that the purpose of this walk is to observe environmental problems around the school.

2) Before leaving the room ask the class to suggest problems they can expect to see. (list on board)

a) litter
b) graffiti
c) abandoned cars
d) noise pollution
e) black smoke from chimneys
f) exhaust from cars
g) etc.

3) During the walk have children make observations of environmental problems seen. (If you want, keep records on where the problems occur, and upon returning to the classroom make a map of your neighborhood and indicate on the map all the environmental problems your class observed.)

SUMMARY:

1) Upon returning to the classroom compare the list of observed problems to the list the class made before the walk.

2) What is the cause for all these environmental problems we observed? (Man)

3) Will we have to learn to live with these problems or are there ways to stop them?

LESSON 13

Introduction to the Aluminum Recycling Unit

The following lessons can be used as a starting point for an aluminum recycling program or as part of a general unit on the environment.

TO START AN ALUMINUM RECYCLING PROGRAM

1. Ask permission to start an aluminum recycling program from the school administrator.

2. Solicit the aid of the custodial staff to help find a place to store the aluminum.

3. Ask the Parent Association or other teachers if they would help run the program and help transport the aluminum to a recycling center. (A list of recycling centers for the New York City area is included in this unit.)

4. Publicize the school recycling center with posters placed around the school and flyers sent to the parents.

5. Explain to students how to recognize an aluminum can. (See enclosed diagram.)

6. Store aluminum cans, trays, and foil in large plastic garbage bags. (If students crush the cans, with their feet, more cans can be kept in each bag.)

7. The recycling effort can be used as a jump-off point for an interdisciplinary environmental science unit.

LESSON 13 A

ALUMINUM RECYCLING CENTERS IN NEW YORK

Bayshore	Mobil Oil, 1743 Sunrise Hwy & Pentaquit Av. (516-665-9889)
Brentwood	Mobil Oil, Long Island Expwy & Calebs Path (516-273-1400)
Elmsford	Coca-Cola, 555 Fairview Pk.Dr. (914-592-4574)
Freeport	Reynolds/AHRC aluminum reclamation center, 230 Hanse Av.(516-546-7700)
Jericho	Coca-Cola Recycling Ctr.,Brush Hollow Rd. (679-3677)
Long Island City	Pepsi-Cola Recycling Ctr, 5 St. & 47 Rd. (392-1000 x506)
Middletown	Reynolds Aluminum Can Plant, Rte.2, Ballard Rd. (914-692-4514)
Monticello	Coca-Cola Recycling Ctr, Bridgeville Rd. (Old Rte.17) between Quickway Exits 106 & 107 (679-3677)
Mt. Vernon	Pepsi-Cola Bottling Co.Inc.,470 E. Sanford Blvd. (914-699-4700)
Newburgh	Coca-Cola Recycling Ctr, 68 Wisner Av. (679-3677)
NYC-Bronx	Pepsi-Cola Bottling Co.Inc. 2050 Webster Av. (593-1000 x506)
	Reynolds Aluminum Recycling Ctr.3960 Merrit Av. (994-5470)
NYC-Brooklyn	Coca-Cola Recycling Ctr, 1900 Linden Blvd. (679-3677)
	Coca-Cola Recycling Ctr, 18 India St., Greenpoint (679-3677)
	Pepsi-Cola Bottling CoInc., 9701 Av."D" (392-1000 x506)
	Reynolds Aluminum Recycling Ctr, 341 Nassau Av. (387-8400)
NYC-Manhattan	Coca-Cola Recycling Ctr 415 E. 34 St. (679-3677)
NYC-Staten Island	Coca-Cola Recycling Ctr, 2252-56 Forest Av. (679-3677)
NYC	Reynolds Metals Co., operates two mobile aluminum reclamation centers in the NYC metropolitan area in addition to its permanent centers. Schedules and locations in New York and northern New Jersey vary.
Queens	Canada Dry, 69-03 Botdon Av, Maspeth (516-894-8700) open 3rd Sat. every month 10 a.m.-2:30 p.m.
	Continental Can Co., 50-02 55 Av., Maspeth, (516-551-7000) open Mon.-Sat. 9 a.m. - 5 p.m.
	National Can Co., 4-40 44th Dr., Long Island City, (361-9526) open Mon.- Fri. 9 a.m. - 4 p.m.

LESSON 13 B

AIM: Why should we recycle aluminum cans?

MOTIVATION: Hold up several empty aluminum cans and ask class - what should I do with these empty cans?

DEVELOPMENT:

1) Do these empty cans have to become garbage?

2) What is garbage? (Anything which is wasted, rather than saved and/or [recycled] reused.)

3) Why should we go to the trouble of saving aluminum cans for recycling?

   a) To reduce the amount of garbage produced every year. (in New York City 6 million tons, about 5 pounds per person per day).

   b) The garbage has to be put somewhere, and we are running out of places to dump it.

   c) There is only a limited supply of aluminum ore in the earth and if we keep mining the ore, our supply will be exhausted.

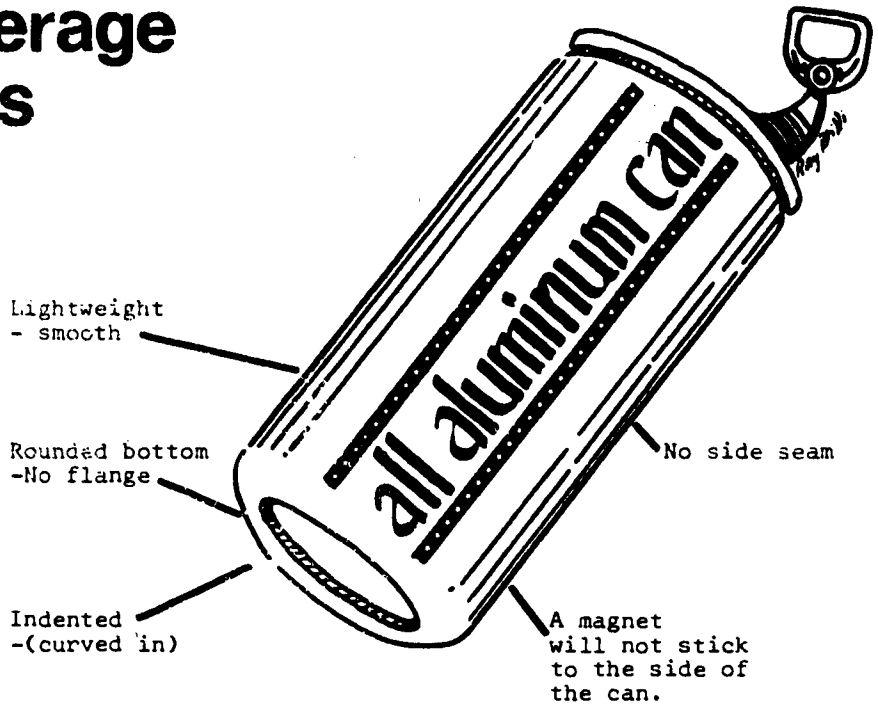
   d) Aluminum is worth money (10¢ a pound) when it is recycled.

4) We are going to do our part to help the environment by: collecting aluminum cans in school, which will be sent to a recycling center.

5) The way to recognize an aluminum can is: (have an example available)

   a) It will be marked "all aluminum".
   b) The bottom is rounded.
   c) There is no side seam.

How to identify all-aluminum beverage cans



Many say 'all aluminum' on the can. All have rounded bottoms.

"Lesson 13B"

LESSON 13 C

AIM: Aluminum Recycling

MOTIVATION: Display or duplicate for students the "Aluminum Can Cycle" diagram.

DEVELOPMENT:

1) What is the story told by this picture?

   a) Where does the story begin?
   b) Where are the cans made?
   c) At which point in the story are the cans filled with soda?
   d) Where do you buy cans of soda?
   e) What is your part in this story?
   f) What are the ways which you can dispose of the empty cans?
   g) What happens to the empty can if you throw it in the garbage?
   h) What happens to the empty can if you take it to be recycled?
   i) Does this story ever have to end? (No, because it is a cycle.)

2) Why would you want to recycle an aluminum soda can?

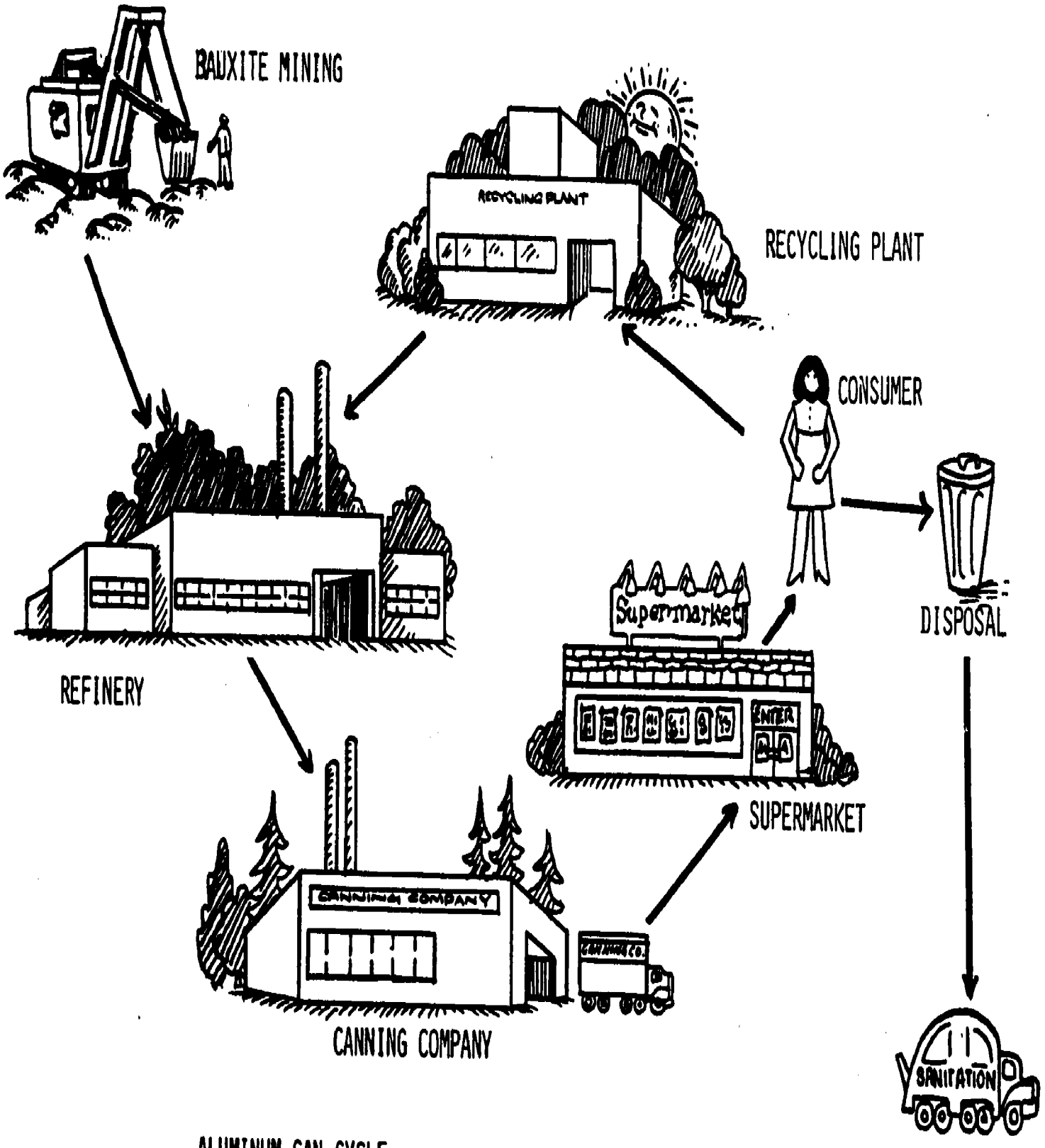
3) What other products are made of aluminum?

4) Why is this picture called "The Aluminum Cycle"?

5) What are the parts of the picture which actually form the cycle?

SUMMARY:

Can other materials be reused and therefore form cycles? Give examples.



ALUMINUM CAN CYCLE

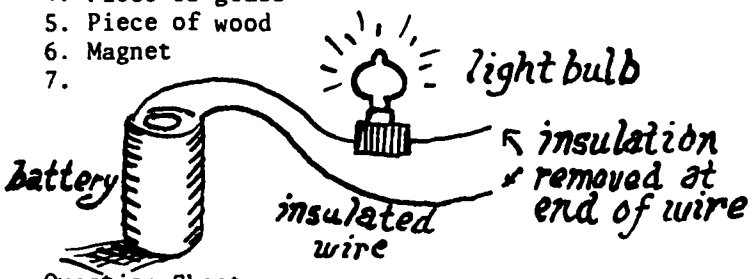
LESSON 13 D

Science Discovery Table #1

Have a table in the room where students can do the following investigations during their free time.

* Objects on the Table

1. Piece of aluminum foil
2. Piece of iron or steel (such as nail or screw)
3. Piece of plastic
4. Piece of glass
5. Piece of wood
6. Magnet
7.



Question Sheet
(Either on handouts or large poster)

1) How many of these objects are shiny?

2) Which of these materials is heaviest?

3) Which material is lightest?

4) Which object bends easily?

5) Do any of these substances conduct electricity? (Test by touching one wire to the end of the object and the second wire to the other end of the object - if the light goes on, the substance conducts electricity.)

6) Which of these substances is attracted by the magnet?

7) How many of these substances are metals?

8) Which one is aluminum? How do you know?

(Write your answers on a piece of paper and give it to the teacher.)

* Objects should be about the same size.

LESSON 13 E

Science Discovery Table #2

Have a table in the room where students can do the following investigation during their free time.

Objects on the Table

1. Aluminum soda can
2. Steel soda can
3. Piece of aluminum or an aluminum nail resting on a moist piece of paper towel
4. Piece of steel (iron) or a steel (iron) nail resting on a moist piece of paper towel
5. Magnet
6. If possible, a very rusted can which is falling apart. (Look in a vacant lot or at a dump.)

Question Sheet (either on handouts or a large poster)

1) Which of the soda cans is aluminum?_____
How do you know it is aluminum?_____

_____

2) Examine the 2 nails on the moist paper. What are the differences between them?_____

_____

3) Is the rusted can made of aluminum or steel?_____ How do you know?

_____

4) What will happen to the rusted can after a long period of time has passed?

_____

5) If an aluminum can is left in a lot or dump, will it rust and break apart?

_____

6) Which type of can (aluminum or steel) would you say is better for the environment? _____Why?_____

_____

7) What is the best way to dispose of an aluminum can?_____

_____

LESSON 14

Introduction To The Tree Unit

Students always enjoy learning about, and growing, their own plants. This unit provides for student participation around the central theme of growing and observing trees.

It is suggested that this unit be used in the spring when plants will grow without the need for artificial lighting and when trees have their leaves.

Some of these lessons could be used individually, thus introducing the topic, in case there is not sufficient time for the entire unit to be used.

LESSON 14 A

AIM: What do trees do for me?

MOTIVATION: Hold up an apple or an orange and ask the class - Where does this come from?

DEVELOPMENT:

1) After the class responds that apples or oranges come from trees, ask them - What other products come from trees, or are made from trees? (List responses on board)

a) paper cups	d) lumber (wood)
b) cardboard	e) chairs
c) paper	f) etc.

2) So far we have mentioned products made from trees or fruit grown on trees. In what other ways are trees useful?

a) Give us shade.
b) Add beauty to an area.
c) Change carbon dioxide to oxygen (photosynthesis)
d) Are homes for birds and animals
e) Roots help hold soil in place.

SUMMARY:

1) Are trees important? Why?

2) Write a short story on: What life would be like without trees.

HOMEWORK:

Have students bring to school examples of products made from trees. (A large experience chart or pupil charts can be made from these examples.)

LESSON 14 B

AIM: Where do trees come from?

MOTIVATION: Hold up a half apple and ask the class - what are these hard little things inside the apple?

DEVELOPMENT:

1) The class should establish that seeds or pits are found inside apples and other fruits. Ask the class - what are these seeds for?

2) After class responds that new trees come from these seeds, ask the class - How can you prove to me that a tree comes from a seed?

3) The class should suggest that you (they) plant the seed and see if a tree grows.

   Have the following materials available:

   a) a container of some sort - flower pot, milk carton, metal can, or plastic container
   b) potting soil or other soil
   c) several apple or orange seeds
   d) some water

   Place the seeds about 1/2 inch beneath the surface of the soil and add some water.

4) Tell the class they will regularly observe the container to see if something starts growing. (It might take a couple of weeks till the plant is visible.)

SUMMARY:

1) Where do new trees come from?

2) How are we going to show where trees come from?

LESSON 14 C

AIM: Observations of a growing tree.

MOTIVATION: Hold up the pot containing the apple seeds you planted with the class and ask - shouldn't we keep some records of how our tree is growing?

DEVELOPMENT:

1) What kinds of observations or measurements should we be interested in keeping? (List responses on the board.)

   a) How many days has our tree been growing?
   b) How tall is our tree?
   c) When did we give the tree water?
   d) Other observations (such as appearance of leaves).

2) Where should we keep all these observations of our tree?

3) Design, with the class, a chart on which all the observations can be recorded (either individual pupil kept charts or one large chart for the entire class).

EXAMPLE

Date	Height of Plant	Plant Watered (Yes/No)	Other Observations

LESSON 14 D

AIM: What are the parts of a tree?

MOTIVATION: Hold up a diagram of a tree and ask the class to name the parts of the tree.

DEVELOPMENT:

1) What is the function or job of the:

a) Roots: (to give the tree support)
(to pick up (collect) water and minerals for rest of the tree)
(to hold the soil in place)

b) Trunk: (to support the leaves and branches)
(to provide a pathway for water and minerals to travel up to the leaves, and for food to travel down to the roots)

c) Branches: (where leaves grow from)
(to hold leaves so they can get sunlight and carbon dioxide)

d) Leaves: (To make food for the tree.
Inside the leaves, water and carbon dioxide (in the presence of sunlight) are changed into food (sugar) for the tree. This process is called photosynthesis. A waste product of photosynthesis is oxygen. The oxygen is returned to the air.)

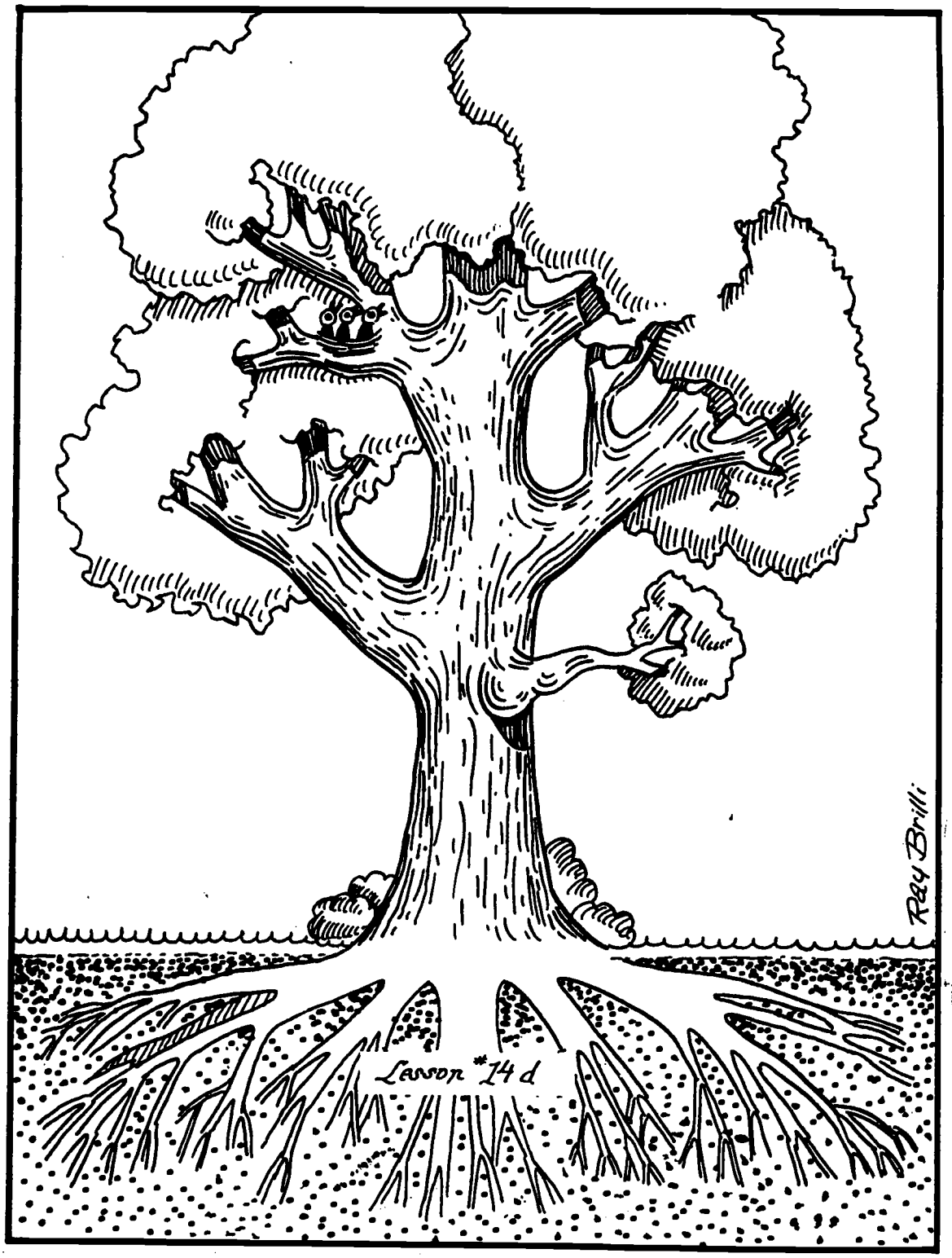
2) What is the bark on a tree for? (To protect the tree from animals, disease, insects, fire and weather.)

SUMMARY: 1) What are the 4 parts of a tree?

2) Where is food made in a tree?

3) What part of a tree collects water and minerals?

4) What is the job of the bark of a tree?


Ray Brilli
Lesson #14 d

LESSON 14 E

AIM: How does our tree grow?

MOTIVATION: Hold up the tree you planted and ask the class - What part of our tree grows first?

DEVELOPMENT:

1) Why do you think the roots would be the first part of a tree to grow? (The roots hold the tree in place, give support to the tree, gather water, and minerals for the tree.)

2) Where do the roots of a tree come from? (The roots grow from inside the seed, down into the soil.)

3) What is the next part of a tree which starts to grow? (The trunk.)

4) Where does the trunk come from? (Inside the seed.)

5) A little tree which has leaves growing from the trunk is called a seedling.

6) Ask the class, where does the growth of a tree occur? In the trunk? At the tip of the trunk? Or at the bottom of the trunk?

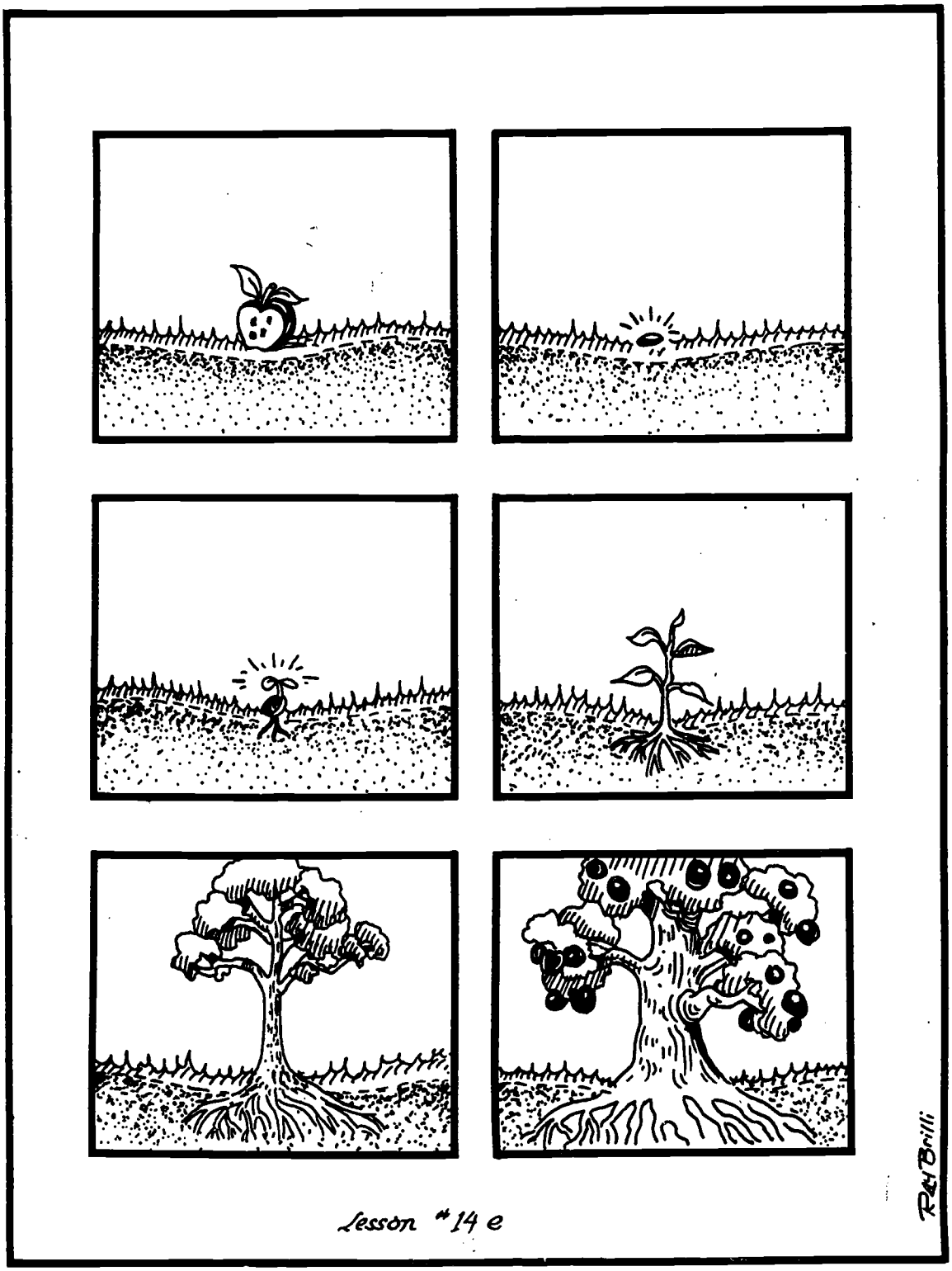
7) We can find out where the growth of a tree occurs by putting a piece of tape on our tree, and then observing if the tape has moved up, or stays at the same height.

SUMMARY:

1) What is the first part of a tree which grows?

2) Where do the roots and trunk of a tree come from?

3) What is a very small tree called?


Lesson #14 e
R&J Brilli

LESSON 14 F

AIM: Trees found around or near our school.

MOTIVATION: Class will go on a walk around the school to observe trees.

DEVELOPMENT:

1) Take class outside and locate a tree near the school

2) Once the tree has been located the class can observe the following things.

a) What are the parts of this tree? (roots, trunk, branches, leaves)
b) How big around is the tree? (Measure in inches, feet. Can one pupil surround it with his arms? Two pupils? Etc? Or measure using a length of string, which can be marked, showing the diameter of the tree.)
c) How tall is the tree? (Measure in feet; height of a pupil; height of the teacher: or height of surrounding buildings.)
d) How far out do the branches of the tree spread?
e) What do the leaves look like? (If possible, collect a few.)
f) Can you see the roots of the tree?
g) Are there any nuts or seeds around the tree? (If possible, collect a few.)
h) What is the general shape of the tree?
i) Do any animals or birds live in the tree?

SUMMARY: Upon returning to the classroom the class can do any of the following.

1) Record observations about the tree you looked at.

2) Make an experience chart about your visit with a tree.

3) Write a short story about "Our Trip To See A Tree."

4) Draw pictures of the tree the class visited.

LESSON 15

AIM: Why should we be concerned with the recycling of paper?

MOTIVATION: Hold up a garbage can full of papers and ask the class - what will happen to this garbage?

DEVELOPMENT:

1) List responses to motivation on the board.

2) Where does paper come from?

3) What other products are made from trees?

4) What do you think life would be like without all these products?

5) At this time, there are enough trees to make all the wood and paper products we need. We might not have enough trees in the next 10 years.

6) If we won't always have an abundant supply of trees, where will paper come from?

7) Can paper be recycled?

8) Here are some examples of products made from recycled paper:

   a) Con Ed envelope
   b) Marcal tissues
   c) paper

9) Why should we be concerned with recycling now?

   a) To save trees which produce oxygen and hold the soil in place.
   b) To cut down on the amount of solid waste.
   c) To prepare for the future.

SUMMARY: Why should we be concerned about recycling?

AIM: Paper -- where it comes from and where it goes.

MOTIVATION: Distribute diagram (Lesson #16) to the class. Ask the class to look at the diagram and write a story about what happens to a tree. The student should write the story imagining himself/herself to be the tree.

DEVELOPMENT:

1) Have several students read their stories to the class.

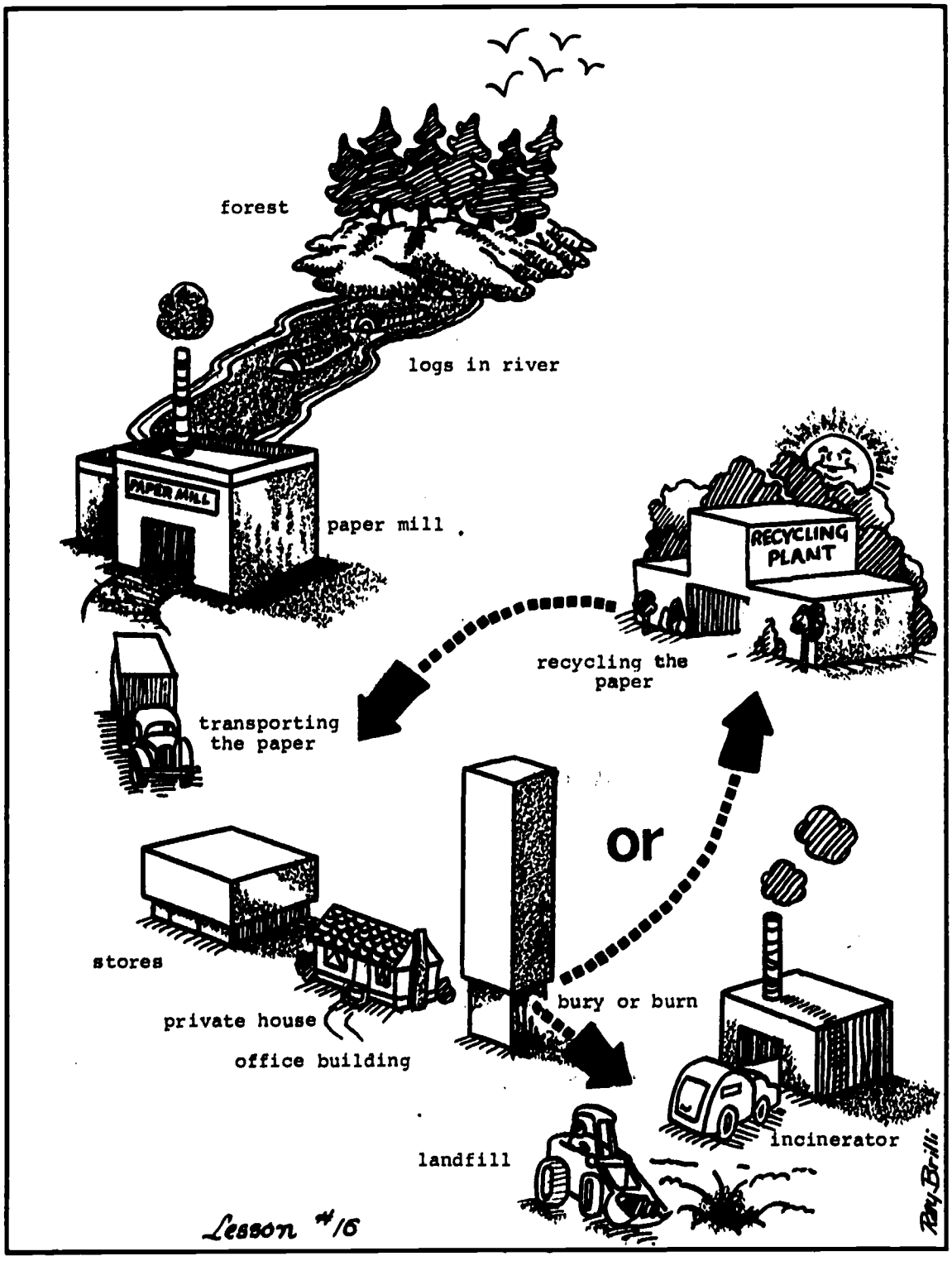
2) Discuss with the class what choices are available when dealing with waste paper.

   i.e. a) What are the advantages to recycling waste paper?
   b) Can cities be considered large forests?
   c) What are the disadvantages to incineration of paper or putting waste paper in a landfill?

3) Ask the class to cite examples of recycled paper that they have seen or used.

HOMEWORK:

Have students bring to school examples of recycled paper. Start a bulletin board display of recycled paper products.

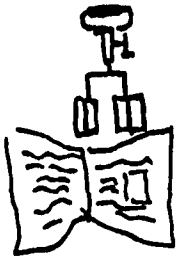

forest
logs in river
PAPER MILL
paper mill
RECYCLING PLANT
recycling the paper
transporting the paper
or
stores
private house
office building
bury or burn
incinerator
landfill
Lesson #16
Ray Brill

LESSON 17

MAKE YOUR OWN RECYCLED PAPER

Materials you will need:

one bucket or large bowl



one egg beater

one newspaper

one piece of window screen
about four inches square

instant starch (This is not necessary, but it will make the paper stronger.)

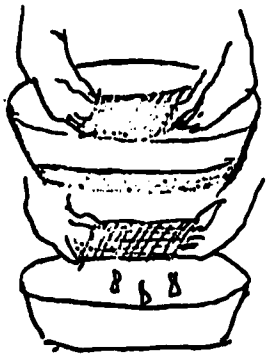
two or three used pieces of paper

Directions:

Tear the paper into very small pieces. Put the small pieces in the bowl.

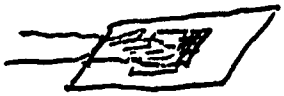
Fill the bowl with water. It is best to use warm water, if possible. If you want to use the starch, add 2 teaspoons of it to the water now.

Let the paper soak in the water for at least 10 minutes. Then beat it with the egg beater until it becomes soft and mushy. This is called "pulp."

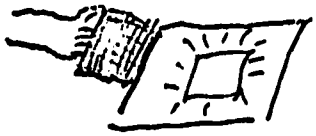


Dip the screen into the bowl carefully, tilting it so that the edge goes in first. Then lift the screen up flat, letting the pulp cover the screen.

Let the water drip back into the bowl.

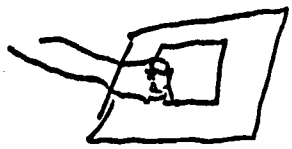


Turn the screen upside down on the newspaper. This has to be done carefully so that the pulp doesn't all come apart.



Slowly and carefully take off the screen. Don't move the pulp! The pulp should stay on the newspaper.

Leave the pulp on the newspaper until it dries. When it is dry, you will have recycled paper!



Slowly take the recycled paper off the newspaper.

Of course, your recycled paper is much thicker and rougher than recycled paper made in a paper mill. It doesn't look like the recycled paper these instructions are written on. That's because paper mills have all kinds of machines to make the paper smooth and flat.

This is 100% recycled paper.

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235 E. 49th Street
New York, N.Y.

9/72

LESSON 18

Teacher - Introduction

To The

Student Environmental Survey

This unit is designed to involve students in monitoring a few pollutants found in their environment.

The unit can be as short or as long as you like. If you want to use this over a long period of time, use the Student Environmental Survey as an introduction to the study of the environment and work other lessons from this collection of lessons around the basic project.

If you want to use this as a short unit, you can use the Student Environmental Survey as a follow-up to your other environmental studies.

The Survey equipment will cost about $20.00 to build. It can be constructed either by the students, or by the teacher. (See attached plans.) Once the unit is built, it could be used by several classes, thus allowing the cost to be shared.

The equipment is designed to measure 3 kinds of pollutants: particulate matter, carbon dioxide, and noise. As you will see in the accompanying diagrams, the Student Environmental Survey Apparatus is compact enough to be housed in a cigar box.

LESSON 18 A

Instructions for Assembling and Using the Student Survey Apparatus

I. PARTS LIST (Lafayette parts were used because they are readily available. One could substitute equivalent parts from other electronic parts suppliers.)

Part	
(1) Micro ammeter (0-50)	#99P50429
(1) 3 watt amplifier	#99P91324
(1) photoelectric cell	#9962432
(1) microphone	#9945130
(1) volume control switch	#9960196
(1) Potentiometer (0-100)	#33P1365

(1) cigar box
(3) single throw switches
(1) light bulb
(2) 2 "D" cell batteries
(1) 9V. battery
(1) small wood block 2" x 2" x 1"
wire
(2) "D" cell battery holders

II. ASSEMBLY INSTRUCTIONS

To assemble the student Environmental Survey Apparatus, use sheet 18B as a wiring diagram. Side 1 of the page is a general wiring diagram and Side 2 shows the details necessary in order to correctly connect wires to the various parts. Please notice that the one ammeter is used in both circuits. Sheet 18C shows one possible way to arrange the equipment in a cigar box.

CONSTRUCTION HINTS

a) When soldering wires to the amplifier, be careful not to spread solder across any of the printed circuits.

b) The block of wood should have 2 holes drilled in it. The hole, on the top, should be the size of a test tube. The hole, going through from one side to the other, should be large enough to allow the light bulb to sit inside it.

c) A good holder for the light bulb is a standard porcelain lightbulb holder. Remove the porcelain and mount the remaining pieces as shown in the diagram on Sheet 18B, Side 2.

d) In the hole used for the test tube, also saw or file two slots so a glass slide will fit into the block.

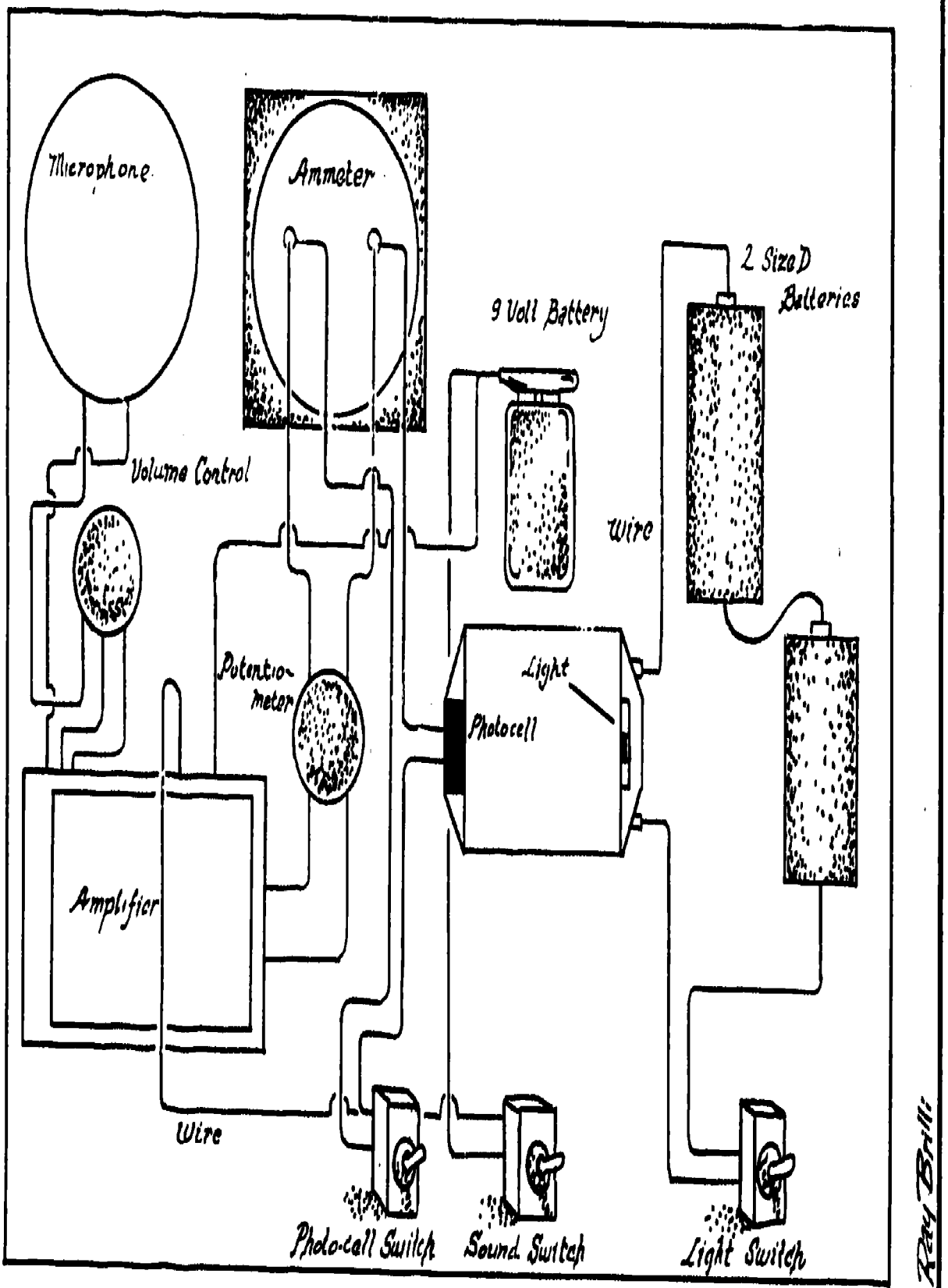
III. OPERATING INSTRUCTIONS

After assembling the Student Environmental Survey Apparatus, the equipment should be tested. The easiest circuit to test is the one composed of the light and the photoelectric cell. Turn on the switch for the photocell; then turn on the switch for the light bulb. The needle on the ammeter should move. Put your finger in the test tube hole and see if the needle on the ammeter drops down towards zero. If the equipment has functioned properly up to this point, you are ready to test if it will measure particulate matter and carbon dioxide.

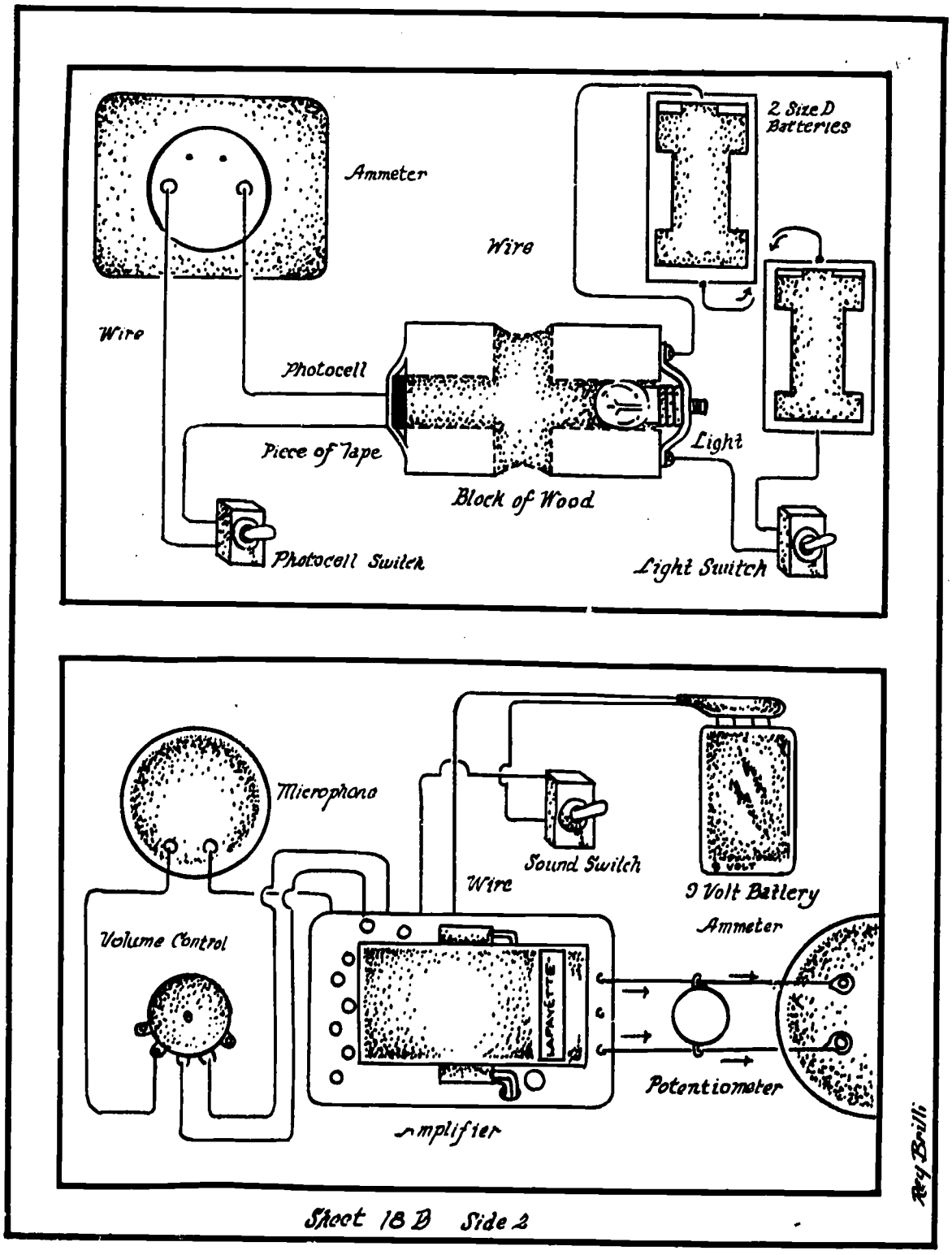
To measure particulate matter, take a glass slide and put a very thin coat of vaseline on it. (Use your finger to apply the vaseline.) Place the vaseline-coated slide in the prepared slots and read the ammeter. Record this data. For testing purposes (remove the slide from the box), sprinkle some dust or dirt onto the slide. (Under normal use of the equipment, the slide would be exposed to the air for a given time period determined by the teacher.) This dust or dirt represents particulate matter. Place the slide back in the wood block, and again read the meter. There should be a decrease in the reading. The difference between the two readings will be used as a measurement of the amount of particulate matter.

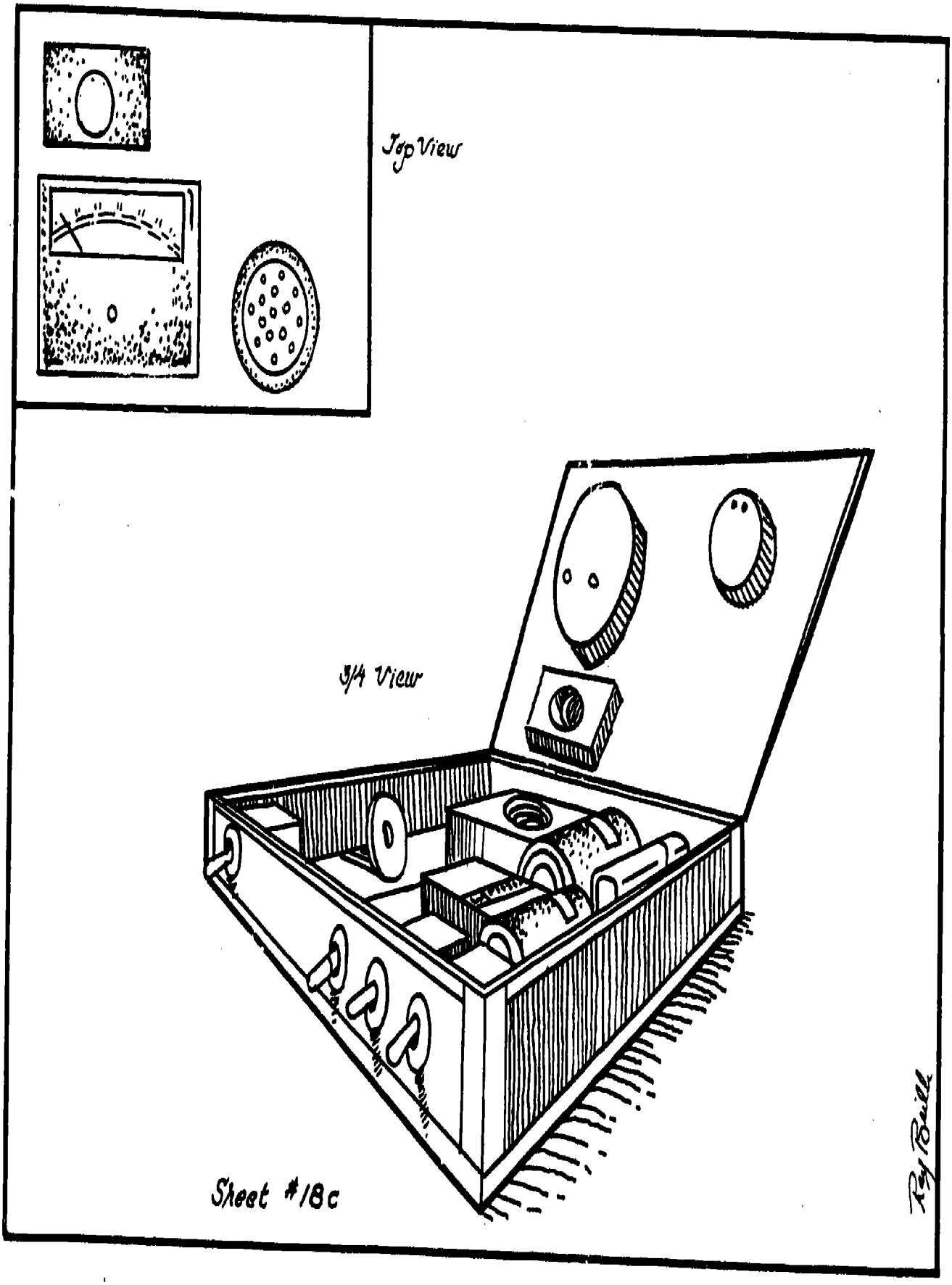
The test for carbon dioxide is conducted in a similar manner to that of particulate matter. Take some lime water and filter it into a test tube. Place the test tube in the wood block and take a reading, for test purposes. Then use a straw to blow air through the lime water . (During the survey students will allow the lime water to be exposed to air for a time period of your choice.) When the mixture has turned cloudy, replace it into the wood block. Take another reading from the ammeter and the difference between the two readings is a measurement of the carbon dioxide level.

To test the Noise Meter, turn the photocell and light off; turn the "sound" switch on. Adjust the volume control to maximum, and delicately adjust the potentiometer to allow the ammeter needle be at zero (when no noise is present). After these adjustments have been made, sound levels are measured by movement of the ammeter needle. Clap your hands, talk, bang on the table, etc. You should see the needle move, thus measuring sound levels.



Sheet 18b - Side 1


2 Size D Batteries
Ammeter
Wire
Wire
Photocell
Piece of Tape
Block of Wood
Light
Photocell Switch
Light Switch
Microphone
Sound Switch
Wire
9 Volt Battery
Ammeter
Volume Control
Potentiometer
Amplifier
Sheet 18 B Side 2


Top View
3/4 View
Sheet #18c
Roy Rowell

LESSON 18 D

AIM: Student - Introduction to Environmental Survey

MOTIVATION: We are going to become involved in a project which will monitor pollution around our school.

DEVELOPMENT:

1) Our class is going to make tests of environmental pollution on a regular basis.

2) Who can tell me what the word "pollution" means?

3) We will study several kinds of pollutants in this program.

   a) particulate matter
   b) carbon dioxide
   c) noise

4) The class will be divided into teams consisting of 2 students per team. Every week a different team will be responsible for making the pollution tests and recording the data.

5) The team will record the data on a large chart and the rest of the class will participate in a discussion of the findings.

6) You should set aside a section in your notebook for this project. All the information on the project should be kept in this special notebook section.

LESSON 18 E

AIM: How are we going to measure some kinds of pollutants?

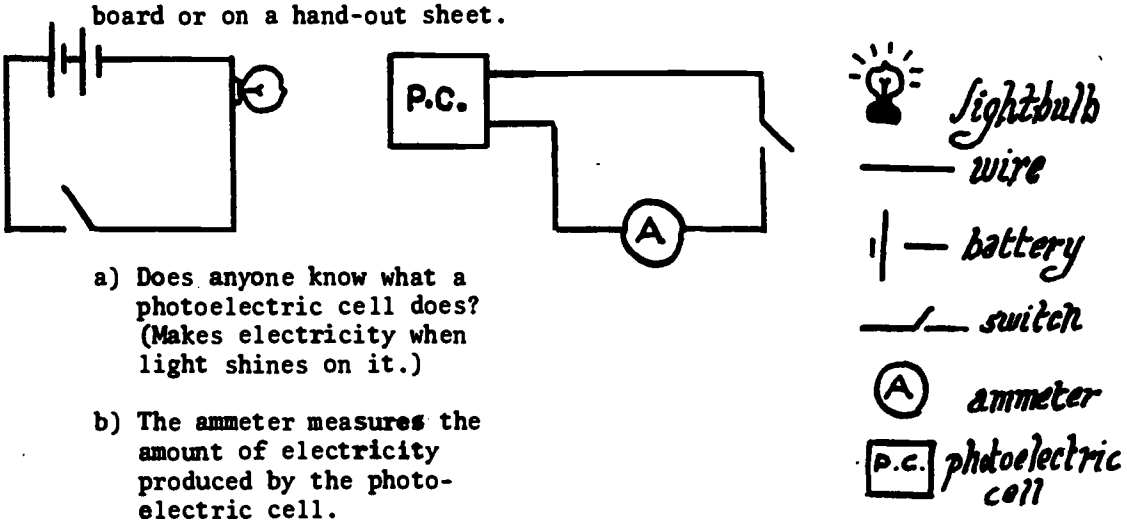
MOTIVATION: Hold up to show class, the completed Student Environmental Survey monitoring apparatus.

DEVELOPMENT:

1) Yesterday, we discussed the Student Environmental Survey program. What kinds of pollutants did we say we would measure?

2) Today, we are going to discuss how this "black box" works.

3) Particulate matter is measured in the following way. Draw diagram on board or on a hand-out sheet.



a) Does anyone know what a photoelectric cell does? (Makes electricity when light shines on it.)

b) The ammeter measures the amount of electricity produced by the photo-electric cell.

4) What happens if we place a piece of black paper between the light source of the photoelectric cell? Why?

5) If we collect particulate matter on a glass slide and place it between the light and the photoelectric cell, what would you expect will happen?

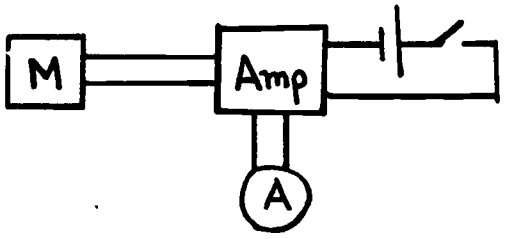
6) Can we use this as a measurement of the amount of particulate matter? How? (We will first measure how much light travels through a clean glass slide, and then compare the reading on the ammeter with a reading taken from a slide covered with particulate matter. The decrease in the reading will be an indication of the amount of particulate matter collected on our slide.)

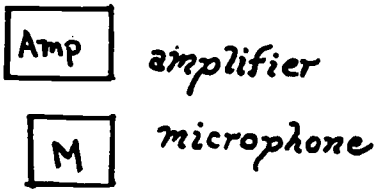
7) Have some lime water in a test tube and a straw. Ask a student to carefully blow air into the test tube. Have students observe the color change.

8) What substance is lime water used to test for?

9) How can we use our "black box" to test carbon dioxide levels?

10) Draw the following wiring diagram on the board.





11) What do you think this piece of equipment (point to diagram on board) measures? (sound/noise)

12) How will we be able to measure noise when there is no speaker to hear it?

13) Will these readings taken on our monitoring equipment tell us anything?

LESSON 18 F

AIM: To design a large graph or chart on which student Environmental Survey Data can be recorded.

MOTIVATION: Students will be conducting the actual data collection and will be, therefore, responsible for recording data on master charts once a week.

DEVELOPMENT:

1) Have the "black box" available. Ask students what kind of data will we be regularly collecting which should be recorded? (particulates, CO_2, noise)

2) Develop with the class a chart or graph on which the weekly data can be placed.

3) Have students make duplicates of the master chart for their notebooks.

LESSON 19

*AIM: What kinds of things are biodegradable?

MOTIVATION: Display a piece of glass, aluminum, paper, apple, lettuce and steel. Ask the class - which of these are biodegradable?

DEVELOPMENT:

1) What does "biodegradable" mean?

2) Ask the class how they could prove that the displayed items are either biodegradable or non-biodegradable.

3) Have soil from a garden or vacant lot, 5 containers (pint milk containers will be good) and 5 pieces of each of the following substances; glass, aluminum, steel, apple, lettuce, and paper.

4) At the suggestion of the class, place soil in each of the 5 containers. Then place 1 piece of each of the 6 substances in each container.

5) Label each container, 1 - 5. Then, at the suggestion of the class, agree to dig up 1 of the containers every week for the next 5 weeks.

6) Each time a container's contents are examined have the class keep observations on the condition of the 6 substances.

7) At conclusion of the 5 weeks, have the class draw conclusions about which substances are biodegradable.

* Note: Try this yourself prior to using it in your classroom.

LESSON 20

*AIM: Where does some particulate matter come from?

MOTIVATION: Class will go outside to conduct part of this experiment.

DEVELOPMENT:

1) Put a piece of clean white gauze over the tailpipe of a car. Turn on the car and wait a few minutes. Turn off the car and examine the gauze. (It should collect particulate matter and turn black in color.)

2) Repeat above, but instead of using gauze, hold a glass slide, covered with a thin film of vaseline, in front of the car's tailpipe. Use a test tube holder to avoid being burned. This slide can then be examined under a microscope.

3) Some paper can be placed in a pyrex beaker, or in an evaporating dish, and set on fire. Hold a glass slide covered with vaseline over the flames and see what is collected on the slide. Use a microprojector to project slide for whole class to see.

4) Ask class to cite other examples of where particulate matter comes from.

   a) incinerators
   b) burning coal and oil
   c) asbestos from brakes of cars
   d) rubber from tires
   e) sprays, etc., from industrial plants

* Note: Always try a demonstration before doing it in front of the class.

LESSON 21

AIM: Our water supply.

MOTIVATION: Distribute diagram (Lesson 21) and tell students to think about what is shown in the diagram.

DEVELOPMENT:

1) When we turn on a water faucet - where does the water come from?

2) How does water get into a reservoir?

3) Do we use water directly from a reservoir? What happens to the water before we use it?

4) When water goes down a drain where does it go?

5) What happens to water in a sewage treatment plant?

6) Where do most rivers flow to?

7) If most rivers flow to the sea, how does water get back to the reservoirs?

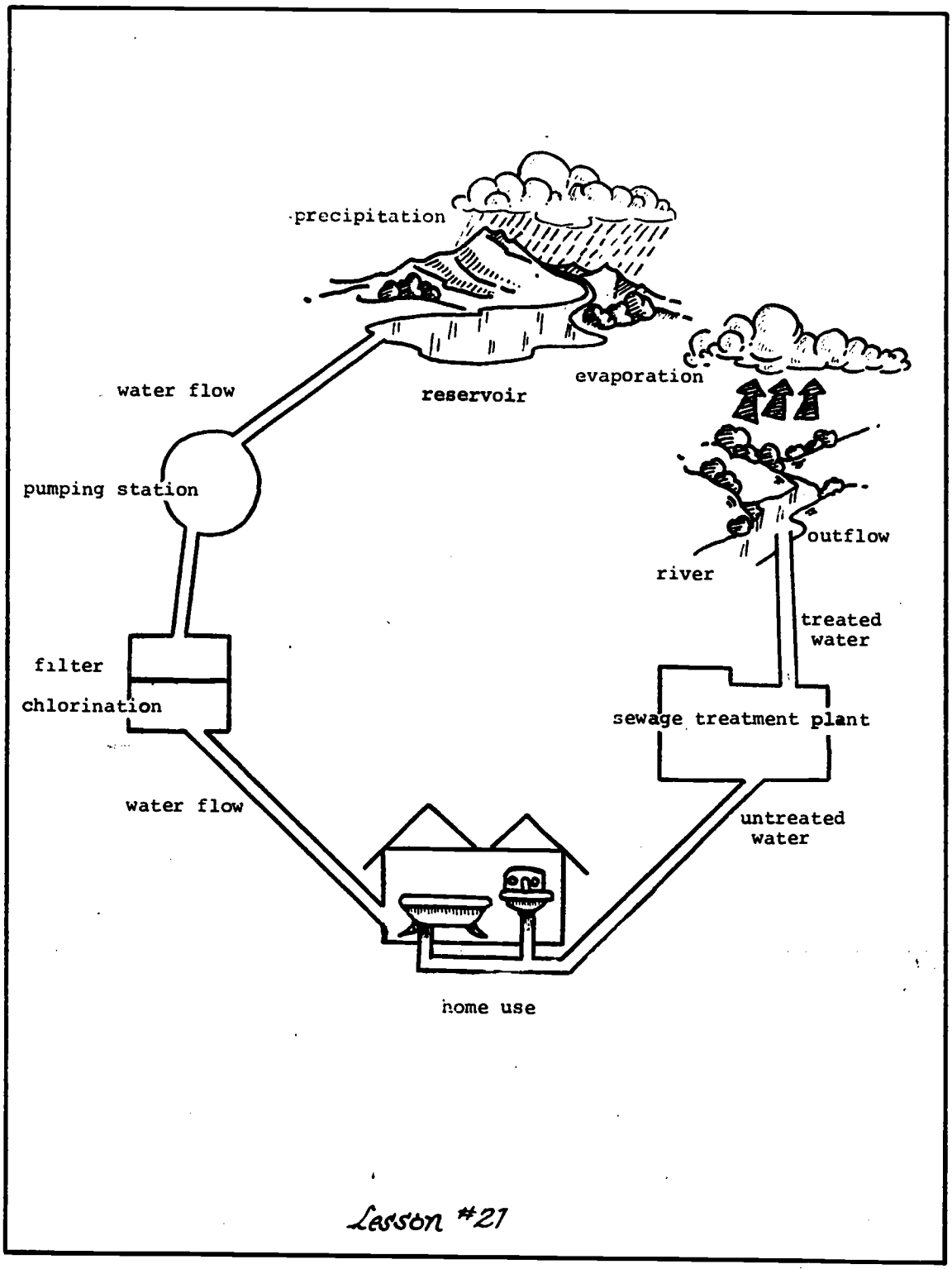
8) What does the word "evaporation" mean?

9) What does the word "precipitation" mean?

10) What are the different kinds of precipitation?

SUMMARY:

Why could this diagram be called "A Water Cycle"?


precipitation
water flow
reservoir
evaporation
pumping station
outflow
river
treated water
filter
chlorination
sewage treatment plant
water flow
untreated water
home use

Lesson #21

LESSON 22

AIM: How is water purified?

MOTIVATION: Distribute the diagram (Lesson 22) of a sewage treatment plant.

DEVELOPMENT:

1) When you use water in your house, it empties into a drain pipe which leads to a sewage treatment plant.

2) Look at the diagram--how many stages are there in the sewage treatment plant?

3) What is the first stage water goes through as it enters the plant?

4) What do you think the screens do?

5) Demonstrate to the class what a settling tank is by doing the following: tell the class that the beaker represents a settling tank; pour in some water/sand mixture and let the beaker stand a while; Ask the class to observe what happens. The sediment which settles out in this stage is removed and, along with the material taken out by the screens is brought to a landfill area.

6) The sewage is next transferred into "digesters." These are large tanks which contain an "activated sludge" (activated sludge contains large numbers of cultivated bacteria which attack harmful waste products in the sewage and make the waste products harmless).

7) The sewage is transferred to another settling tank. What do you suppose happens here?

8) After the sewage leaves the second set of settling tanks, it is filtered to remove any large particles which didn't fall to the bottom of the settling tank.

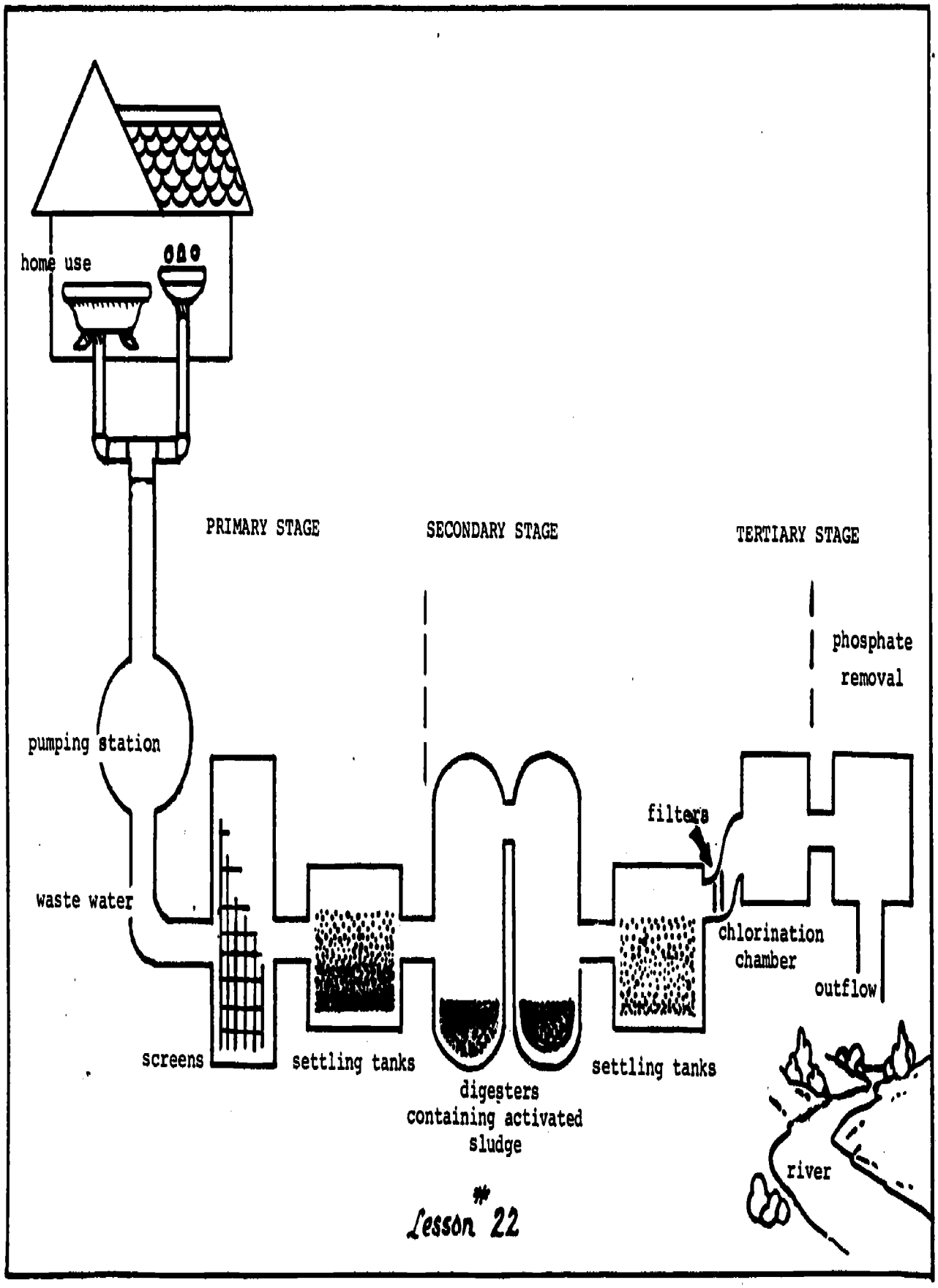
9) The next step in a sewage treatment plant is to chlorinate the water. What does this do? (Kills harmful bacteria.)

10) If the sewage treatment plant is equipped to remove phosphates during the tertiary stage, the water coming out of the sewage treatment plant is very pure, and probably cleaner than the river water it will be poured into.

SUMMARY:

1) Why do we use sewage treatment plants?

2) What part does a sewage treatment plant play in the water cycle?


home use
PRIMARY STAGE
SECONDARY STAGE
TERTIARY STAGE
phosphate removal
pumping station
filters
waste water
chlorination chamber
outflow
screens
settling tanks
digesters containing activated sludge
settling tanks
river

Lesson #22

LESSON 23

AIM: What can I do to protect the environment?

MOTIVATION: When should we be concerned about Our Environment?

DEVELOPMENT:

1) We should be concerned about our environment at all times.

2) How would you describe your environment?

3) If you turn off lights when you leave a room, raise your hand.

4) How does turning off light help to protect the environment?
(Reduces the demand for electricity, which reduces the amount of coal or oil needed to produce electricity.)

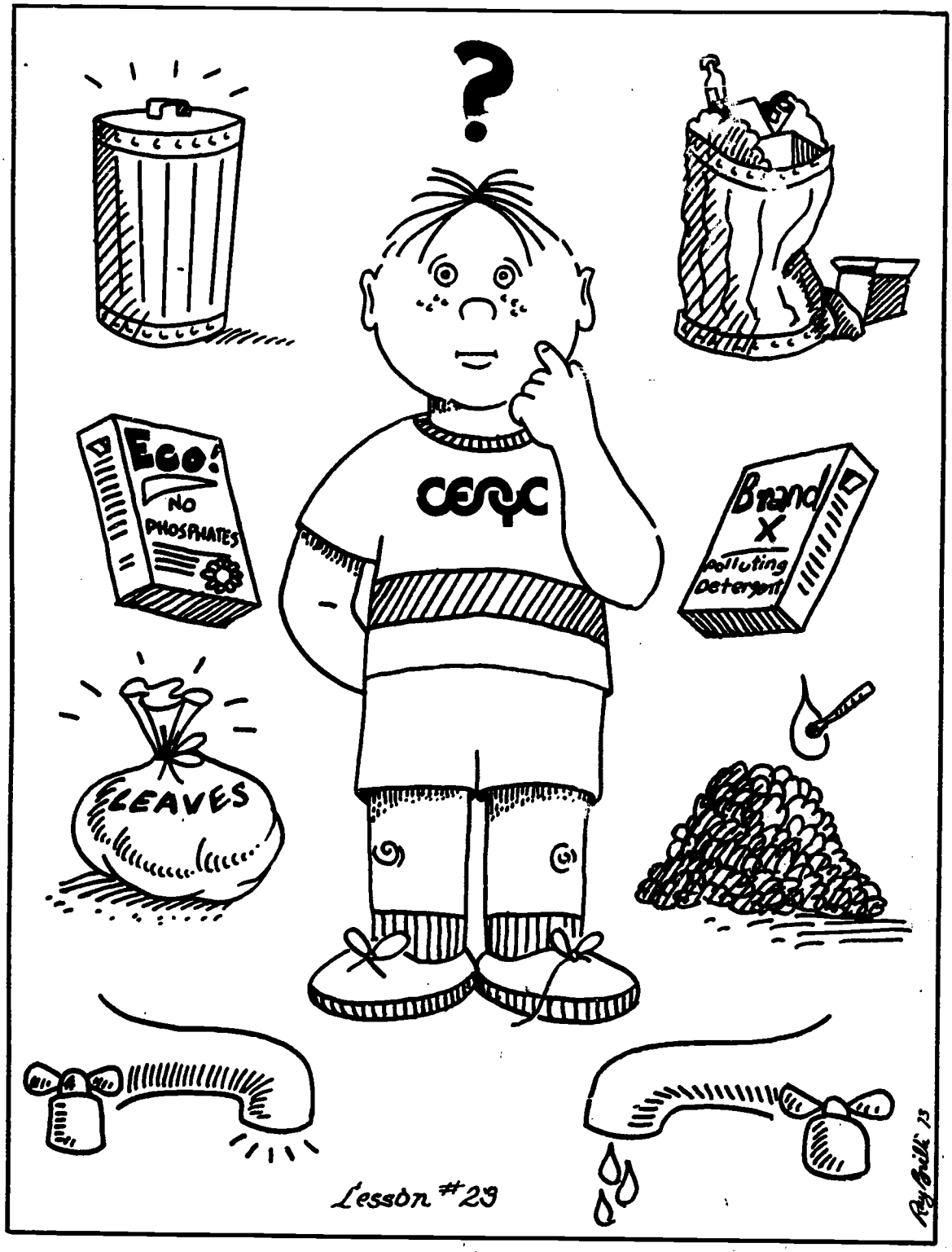
5) Can you think of other things which you can do to protect your environment? (List responses on the board.)

   a) Turn off water when it is not being used.
   b) Turn off T.V.s and other electric appliances when not in use.
   c) Do not waste paper. For example, write notes on both sides of a page. When you make a mistake cross it out or erase rather than starting a new page.
   d) Do not litter. Encourage your friends not to litter.
   e) Recycle aluminum, paper, and other materials whenever possible.

6) Distribute diagram (Lesson 23) to class. Discuss with the class the choices the boy has to make.

SUMMARY:

Why should we be concerned about protecting our environment?


?
Eco:
NO
PHOSPHATES
Brand
X
polluting
Detergent
LEAVES
Lesson #29

LESSON 24

It is suggested that Lesson 24 be an Environmental Field Trip. You are being notified of this lesson at this time so you will be able to arrange for a trip in the spring.

The Environmental Field Trip List gives you 14 suggested places to visit. Many of the places have guided tours available for school groups.

To insure a guided tour for your class MAKE AN APPOINTMENT AS SOON AS POSSIBLE.

1. Department of Air Resources: Phone 566-8977
   guided tours of air monitoring stations

2. Aquarium (Coney Island): Phone CO 6-8500
   guided tours available for school groups

3. Bronx Botanical Garden: Phone 933-9400
   guided tours available for school groups

4. Bronx Zoo: Phone WE 3-1500
   guided tours available for school groups

5. Brooklyn Botanic Garden: Phone MA 2-4433
   guided tours available for school groups

6. Central Park Zoo and Children's Zoo

7. Con Edison: Phone 460-6000
   guided tours for 5th grade and over

8. High Rock Park Nature Conservation Center: Phone YU 7-6233
   year-round education programs

9. Inwood Hill Park Nature Trails: 207th St. & Seaman Av.
   3 trails with tree identification signs, trailside displays, Indian caves, views of the Hudson River and Palisades

10. Jamaica Bay Wildlife Refuge: Phone 360-8127
    guided tours available for school groups

11. Queens Botanical Garden: Phone TU 6-3800
    guided tours available for school groups

12. Queens Zoo: Phone 699-4042

13. Department of Sanitation: Phone 566-5527
    guided tours, for school groups, of incinerators, marine transfer stations, and land fills

14. Staten Island Zoo: Phone GI 2-3100

LESSON 25

Free Or Inexpensive Literature About The Environment

1. PAPER FROM PAPER, NOT TREES
   Marcal Paper Mills, Inc.
   East Paterson, N.J. 07407

2. FOREST APPRECIATION FOR ELEMENTARY TEACHERS
   American Forest Institute
   1619 Massachusetts Av., N.W.
   Washington, D.C. 20036

3. INDIAN VALLEY FOREST MANAGEMENT GAME
   American Forest Institute
   (see #2 above) (one copy free)

4. THE STORY OF HARDWOOD PLYWOOD
   American Forest Institute
   (see #2 above) (one copy free)

5. FORESTS AND TREES OF THE U.S.
   American Forest Institute
   (see #2 above) (one copy free)

6. GROWTH OF A TREE
   American Forest Institute
   (see #2 above) (one copy free)

7. THE SOLID WASTE CRISIS
   The Aluminum Association
   750 Third Av.
   New York, N.Y. 10017

8. THE STORY OF ALUMINUM
   The Aluminum Association
   (see #7 above)

9. LITTER, SOLID WASTE & ALUMINUM RECYCLING: QUESTIONS & ANSWERS
   The Aluminum Association
   (see #7 above)

10. QUESTIONS & ANSWERS ABOUT ALUMINUM CAN RECYCLING
    Public Relations Manager
    Metal Recycling Division
    Reynolds Metals Company
    6601 West Broad St.
    Richmond, Va. 23261

11. JOHNNY HORIZON CLASSROOM KIT
    Department of the Interior
    Washington, D.C. 20240

12. 71 THINGS YOU CAN DO TO STOP POLLUTION
    Keep America Beautiful, Inc.
    99 Park Av.
    New York, N.Y. 10016

13. AIR POLLUTION PRIMER
    Tuberculosis & Respiratory Disease Association
    15 E. 26 St.
    New York, N.Y. 10010

14. INTRODUCTION TO RESPIRATORY DISEASES
    TB & Respiratory Disease Assoc.
    (see #13 above)

15. BREATHING, WHAT YOU NEED TO KNOW
    TB & Respiratory Disease Assoc.
    (see #13 above)

16. THE FACTS
    TB & Respiratory Disease Assoc.
    (see #13 above)

17. LET'S TALK TRASH (35¢)
    National Center for Resource Recovery, Inc.
    1211 Connecticut Av., N.W.
    Washington, D.C. 20036

18. WASTE NOT (15¢)
National Center for Resource Recovery, Inc.
(see #17) above)

19. RESOURCE RECOVERY BIBLIOGRAPHY (75¢)
National Center for Resource Recovery, Inc.
(see #17 above)

20. ENVIRONMENTAL ACTION KIT
Hudson Pulp & Paper Corp.
477 Madison Av.
New York, N.Y. 10022

21. THE STORY OF GLASS CONTAINERS
Glass Container Manufacturers Institute, Inc.
330 Madison Av.
New York, N.Y. 10017

22. GUIDELINES FOR GLASS RECYCLING IN YOUR COMMUNITY
Owens-Illinois
Toledo, Ohio

23. SAVE-A-WATT GAME
Con Edison
4 Irving Place
New York, N.Y. 10003

24. CLEARING THE AIR
Committee on Public Affairs
of the American Petroleum Institute
1271 Avenue of the Americas
New York, N.Y. 10020

25. "FOR YOUR INFORMATION"
(material on Air, Water, Solid Waste, Noise, etc.)
Council on the Environment of New York City
51 Chambers Street, Room 228
New York, N.Y. 10007

LESSON 26

FIND THE HIDDEN WORDS

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

air
aluminum
carbon monoxide
coal
decibel
ecology
environment
garbage
graffiti
incinerator
litter
man
noise
nuclear
oil
paper
particulate matter
pollution
recycle
sanitary landfill
solar
solid waste
tides
tree
water
cycle
wind

LESSON 27

Ecology Crossword Puzzle

ACROSS

1. Everything which affects us directly or indirectly.
17. In a short time.
24. Thing from which plants grow.
28. A picnic pest.
31. A living thing that is not animal.
38. A mixture of gases that surrounds the earth.
41. Equally (adverb).
44. General term for animals in a forest.
52. The part of a plant which grows down into the soil.
58. Suffix meaning small.
64. A lightweight, non-magnetic metal.
76. Of little height.
79. A black mineral which is burned for heat.
84. Short for laboratory.
91. Any solid which is wasted.
101. An inland body of water.
113. Tall grasses which grow in shallow water.
118. To perceive by the ear.
124. Mix by moving around with a spoon.
128. Any large body of salt water.
133. Movable structures for opening or closing an entrance.

DOWN

1. One of the great lakes.
5. The reddish-brown coating that forms on iron or steel when exposed to air or moisture.
8. Male human being.
11. A large plant with a woody trunk.
24. Found in the sky at night.
27. A kind of particulate matter.
28. A living thing that is not a plant.
31. A round container.
32. Time of being alive.
33. Verb: plural of the present indicative of "be".
47. A musical instrument.
64. The whole of
69. Of, like, or forming a nucleus (adj.).
74. Small body of running water
75. Blossom.
78. Condition of the atmosphere with respect to temperature, moisture, etc.
82. Plural of leaf.
113. Large body of running water.
128. Compass direction.