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ABSTRACT

This booklet is one of a set of learning modules on energy for use by students and teachers in the fourth grade. This module examines man's use of fossil fuels, electricity production, and other energy sources. Included are laboratory activities and values exercises. (BT)

NATURE'S ENERGY

MODULE B FOURTH GRADE

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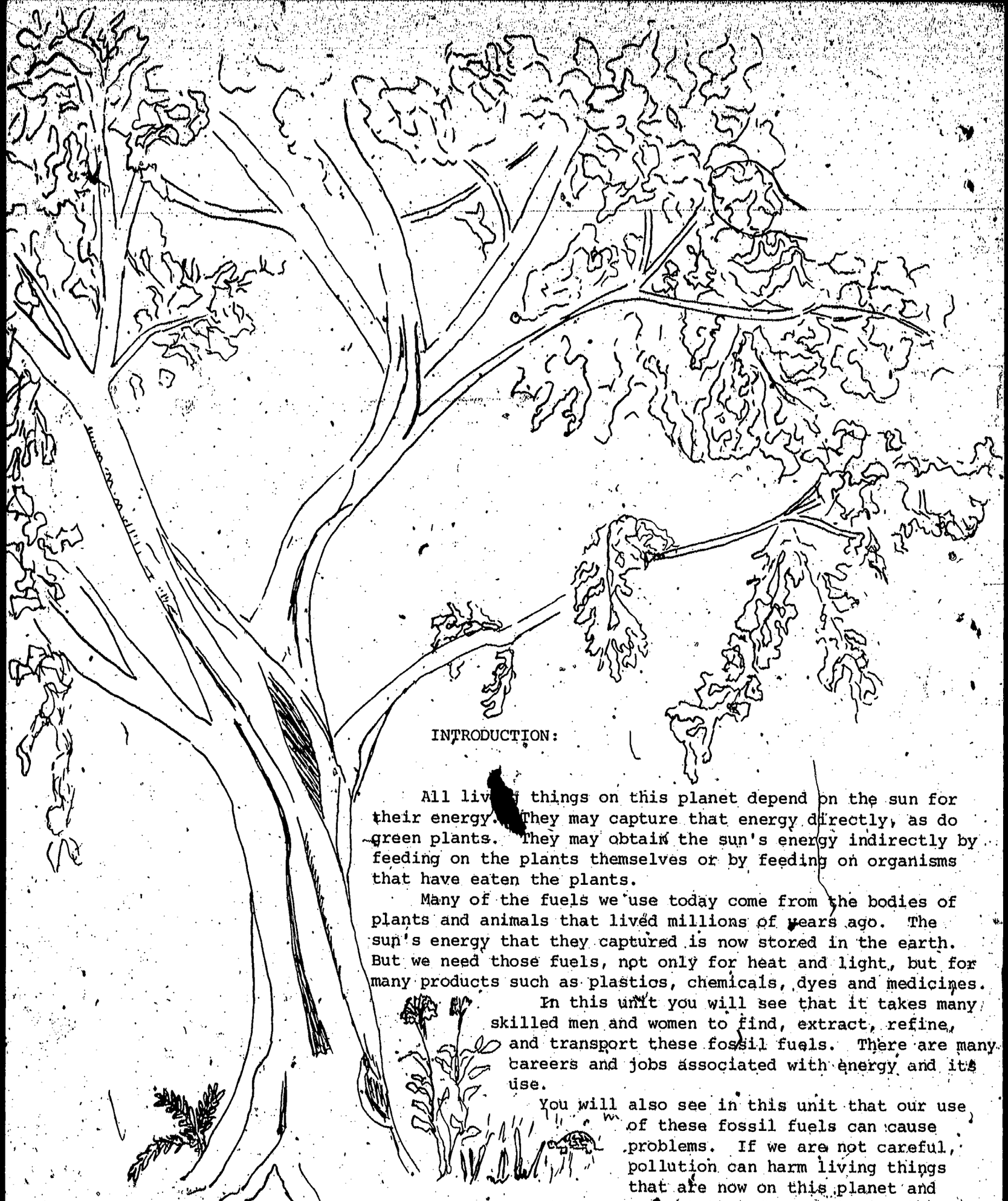

INTRODUCTION:

All living things on this planet depend on the sun for their energy. They may capture that energy directly, as do green plants. They may obtain the sun's energy indirectly by feeding on the plants themselves or by feeding on organisms that have eaten the plants.

Many of the fuels we use today come from the bodies of plants and animals that lived millions of years ago. The sun's energy that they captured is now stored in the earth. But we need those fuels, not only for heat and light, but for many products such as plastics, chemicals, dyes and medicines.

In this unit you will see that it takes many skilled men and women to find, extract, refine, and transport these fossil fuels. There are many careers and jobs associated with energy and its use.

You will also see in this unit that our use of these fossil fuels can cause problems. If we are not careful, pollution can harm living things that are now on this planet and prevent them from capturing the sun's energy that they need.

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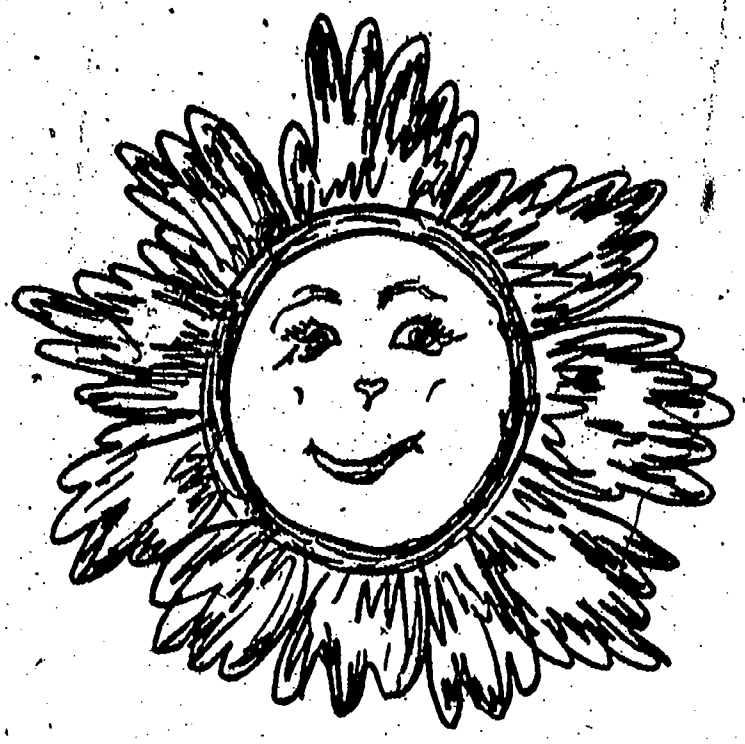
L.A.P. THREE
THE NATURE OF SOLAR ENERGY

THE SUN

Our sun is a very hot star. It is more than 10,000 degrees. It is made up of many different kinds of gases that are constantly burning, sending us heat and light. The sun is also very large. More than a million Earth's could be put inside the sun if it were hollow.



The sun looks small because it is so far away. In fact, it is 93,000,000 miles away. If the sun were much closer everything on earth would burn up. If the sun were any farther away, the world would freeze. We are very lucky that the sun is just far enough away to keep us pleasantly warm. The sun will keep burning for millions and millions of years.

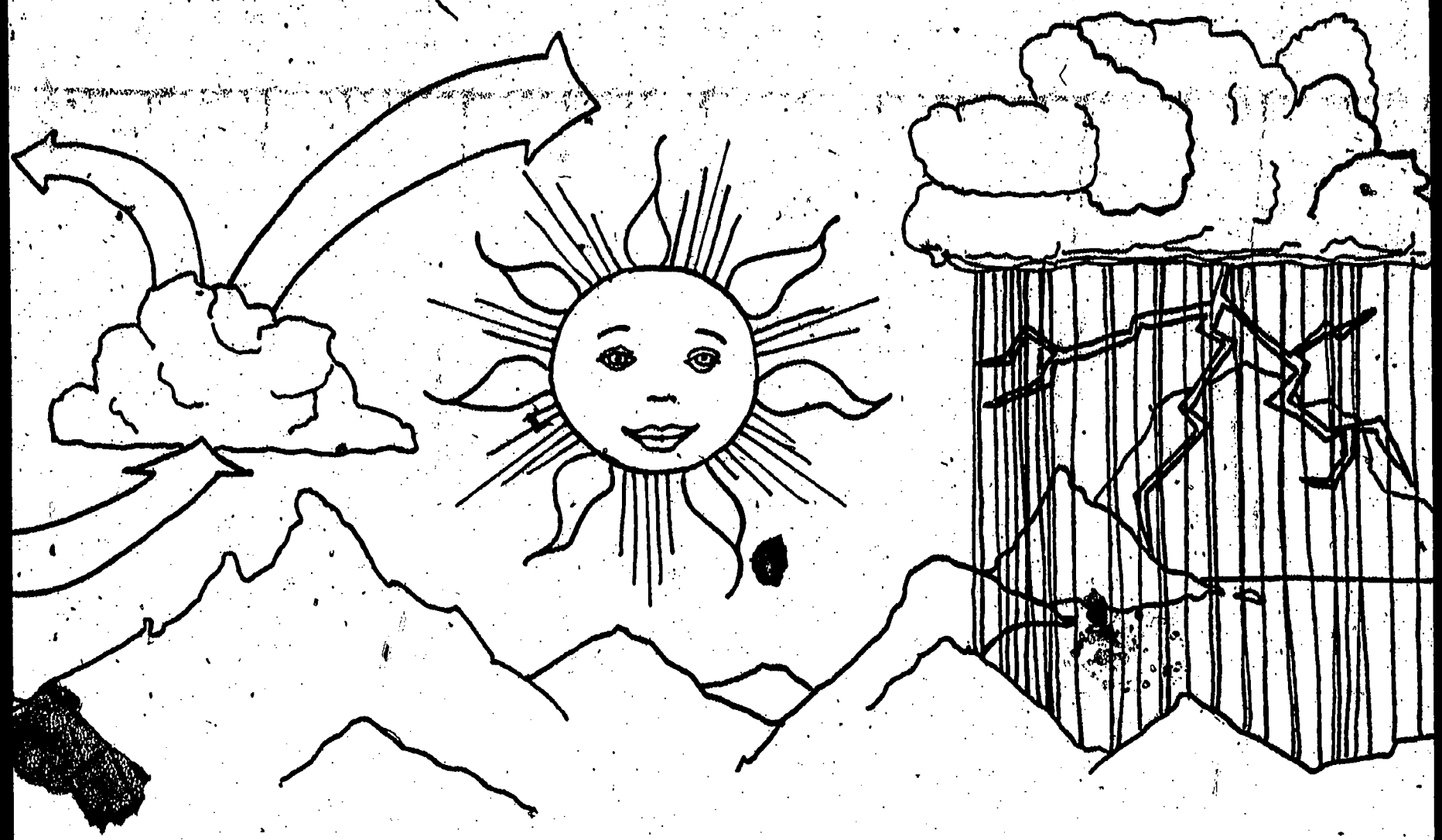
The sun is made up of _____.
The sun is _____ million miles away.
What would happen if the sun were any closer? farther away?

_____

_____

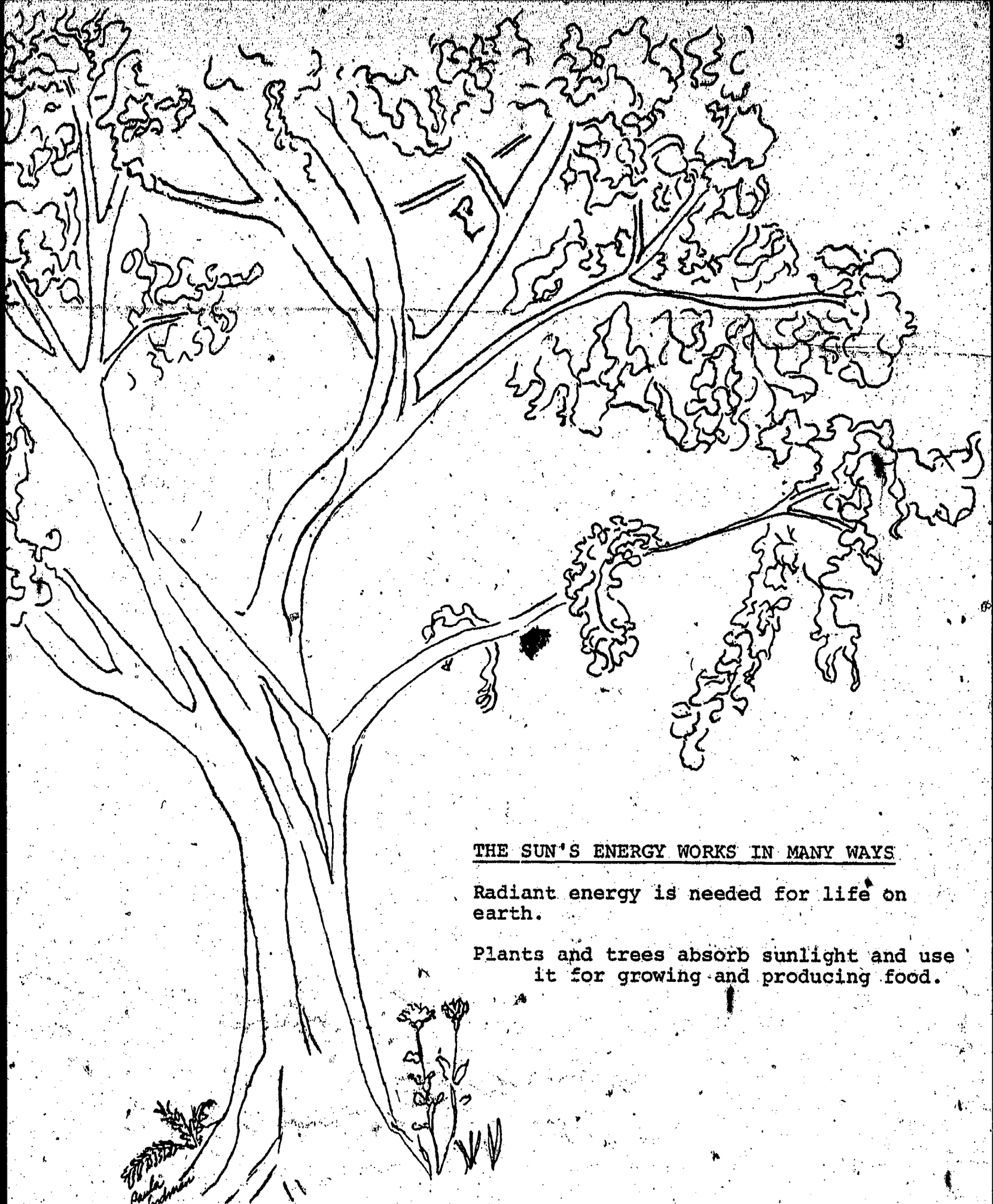
SOLAR ENERGY

Energy is the ability to do work. It can be used to move things, or it can change things in one way or another. The energy that comes from the sun is called solar (or radiant) energy. It comes to us in the form of heat and light. Solar energy can make water evaporate.....



..... or make green plants grow. The two kinds of energy we get from the sun are _____ and _____.

Without solar energy no one could live on the earth. No animals could live and no plants could live.

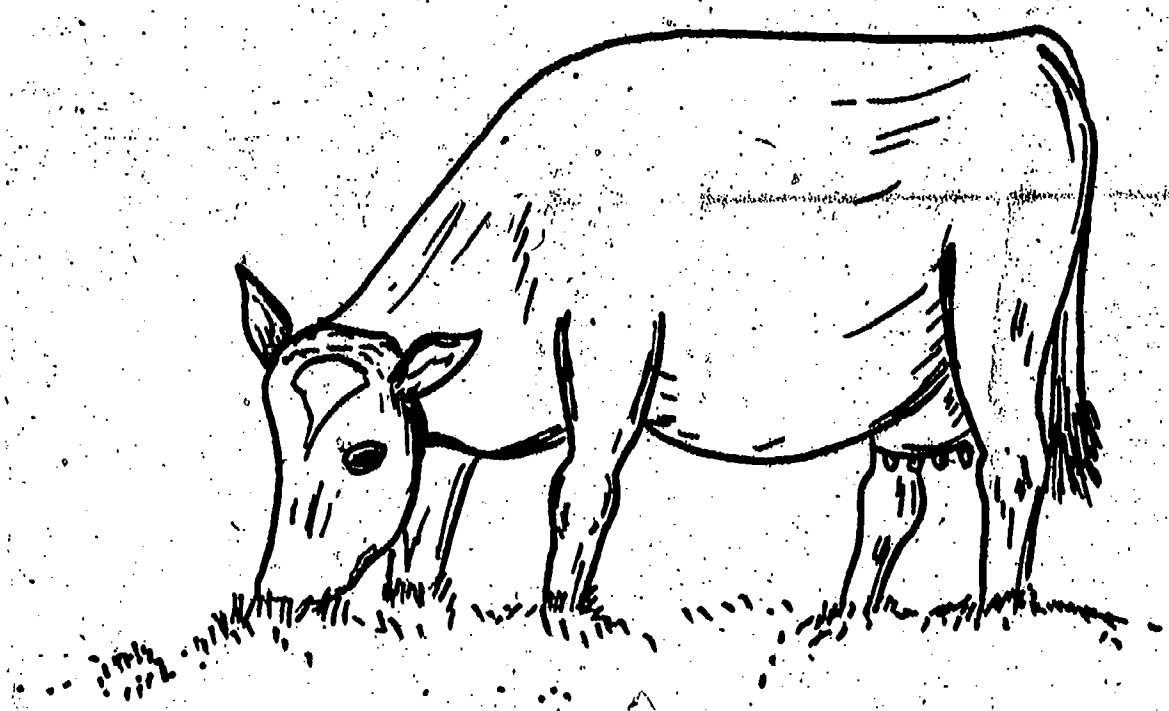


THE SUN'S ENERGY WORKS IN MANY WAYS

Radiant energy is needed for life on earth.

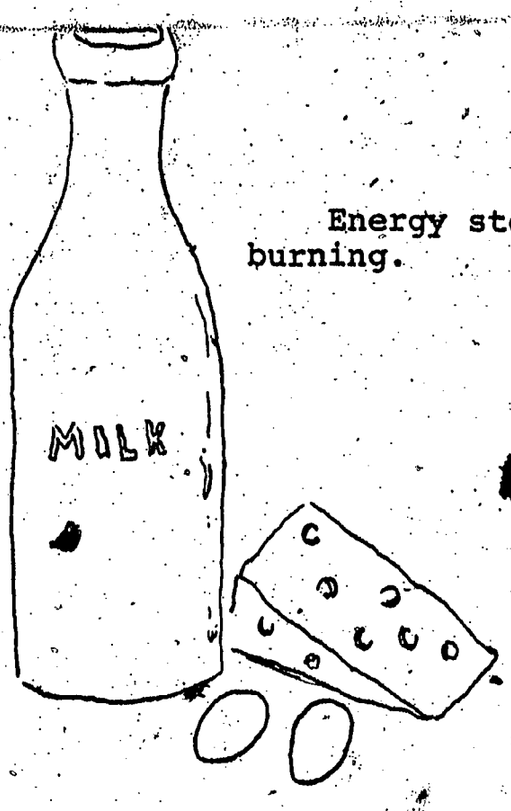
Plants and trees absorb sunlight and use it for growing and producing food.

The radiant energy helps the grass grow. The grass is eaten by cattle.



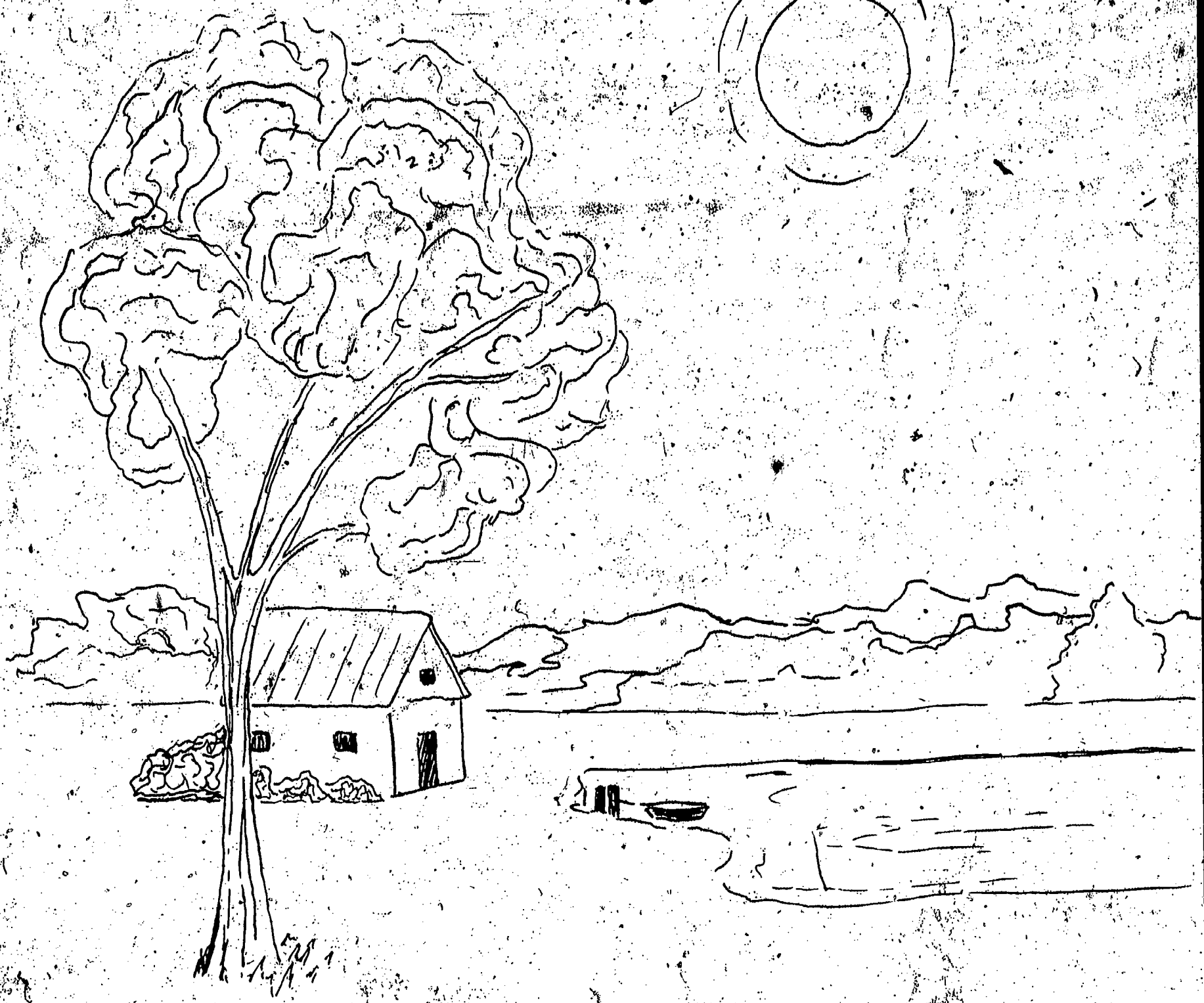
Plants that have absorbed energy from the sun can be eaten to provide energy for people and other animals.

The products of animals that have eaten plants can also supply food energy.



Energy stored in plants can be released through burning.

The energy from the sun which is stored in plants is used in many ways.



The energy that falls on the earth from the sun can be used in a great many ways to do work.

The sun's energy warms the earth.

Water vapor rises high in the air, where it eventually cools and condenses into clouds.

When the water droplets in the clouds get large enough, it rains. This rain provides water to thirsty plants and animals and fills lakes and streams.

OUTDOOR OBSERVATION
SOLAR ENERGY

You have learned that energy is the ability to do work and can be used to move things or can change things in one way or another.

Go outside and look around you. See how many ways you can hear, see, and feel energy from the sun. Remember: most kinds of energy are a result of solar energy. For example, children playing are using energy from the food they ate, which was grown as a result of solar energy. Fill in the following chart with your observations.

OBSERVATIONS OF SOLAR ENERGY

SEE	HEAR	FEEL

L.A.P. THREE -
PRODUCERS AND CONSUMERS

GREEN PLANTS AND ENERGY

Getting food is important work for all living creatures. Nothing can live without food. How do most animals get food? They can move around after the plants or other animals they eat.

Do plants get food this way? No, plants have a different way to get food. Green plants are the only living organisms that can make their own food from its raw materials - water, a few minerals, and a gas called carbon dioxide which is in the air. From these, the plant makes a food sugar.

Because green plants produce their own food sugars, they are also known as producers.

Can animals make their own food? Animals use up, or consume, other animals or plants. They are called consumers. Can animals live without the plant producers for food?

Foxy Loxy lived in a forest, feasting on mice and rabbits. A terrible blight killed all the plants. Foxy doesn't eat plant producers anyway. Will he be able to survive in the forest?

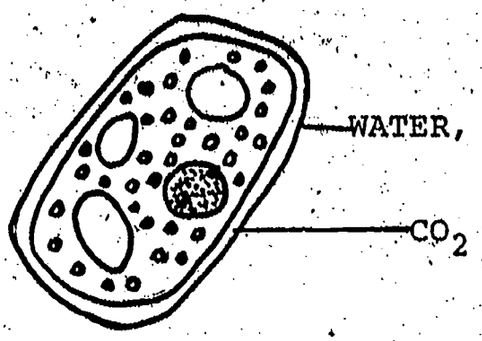
Foxy is a	producer	consumer
Rabbits are	producers	consumers
Mice are	producers	consumers
I am a	producer	consumer

The only producers are green ___ ___ ___ ___ ___ ___.

HOW PLANTS ARE BUILT TO MAKE FOOD

Every plant and animal is made up of very small parts called cells, which can be seen with a microscope.

Some plants are made of only one cell. To make food, one celled plants use water, minerals and carbon dioxide which comes into the cell through the cell wall.



A plant like a dandelion is made of many different cells, forming roots, stems, leaves, flowers and seeds.

How does the plant make food? The green plant needs water, minerals, carbon dioxide and energy from sunlight.

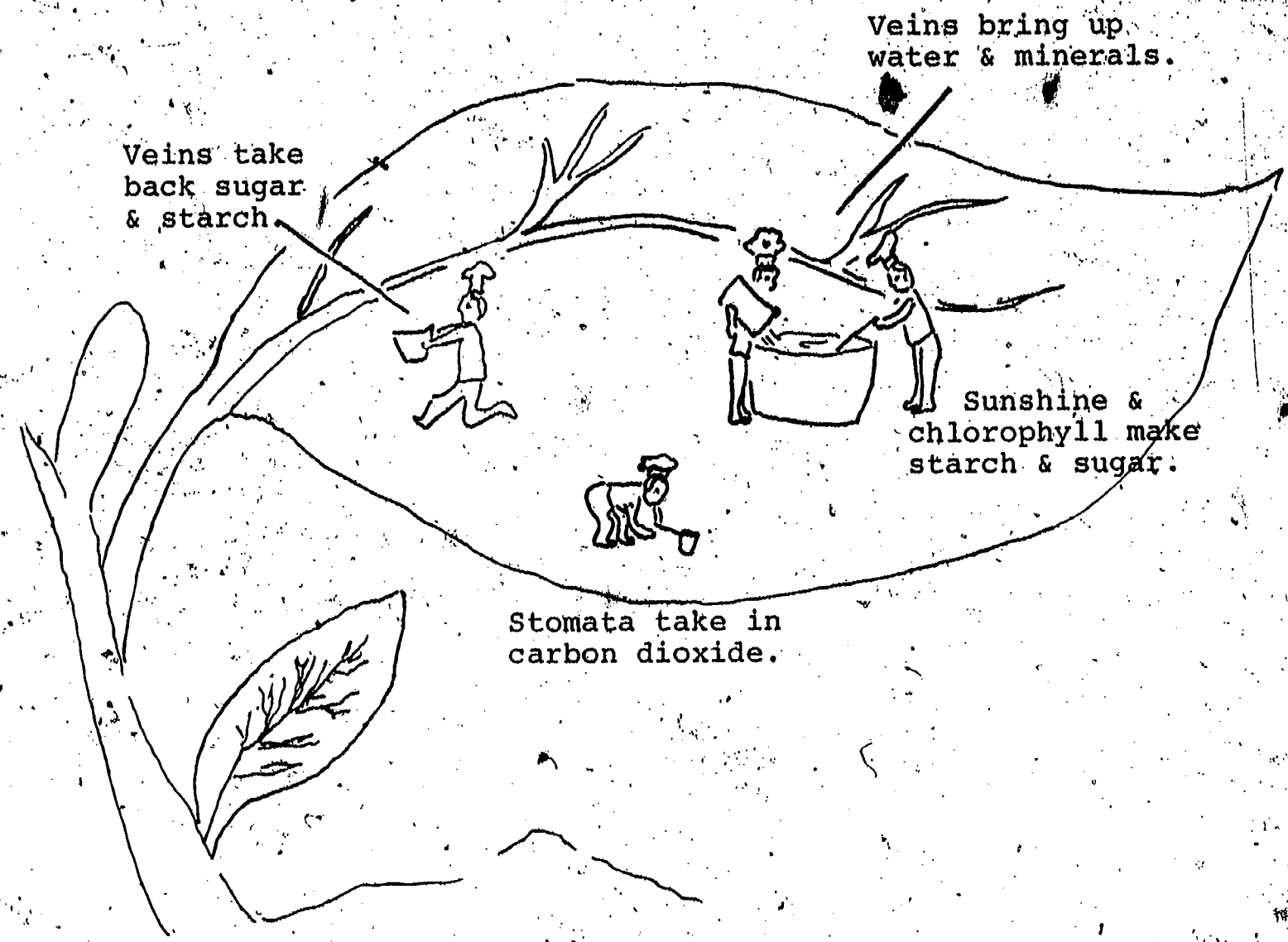
Plants which are green have a green substance called chlorophyll. Chlorophyll acts like a screen to trap the light's energy.

Light energy is trapped by chlorophyll. (Experiment 2) Water is taken up by the roots. Water is a good dissolver, and it contains the minerals which the plant needs. (Experiment 3)

The carbon dioxide gas gets into the plant through thousands of tiny openings in the leaf. (Experiment 4)

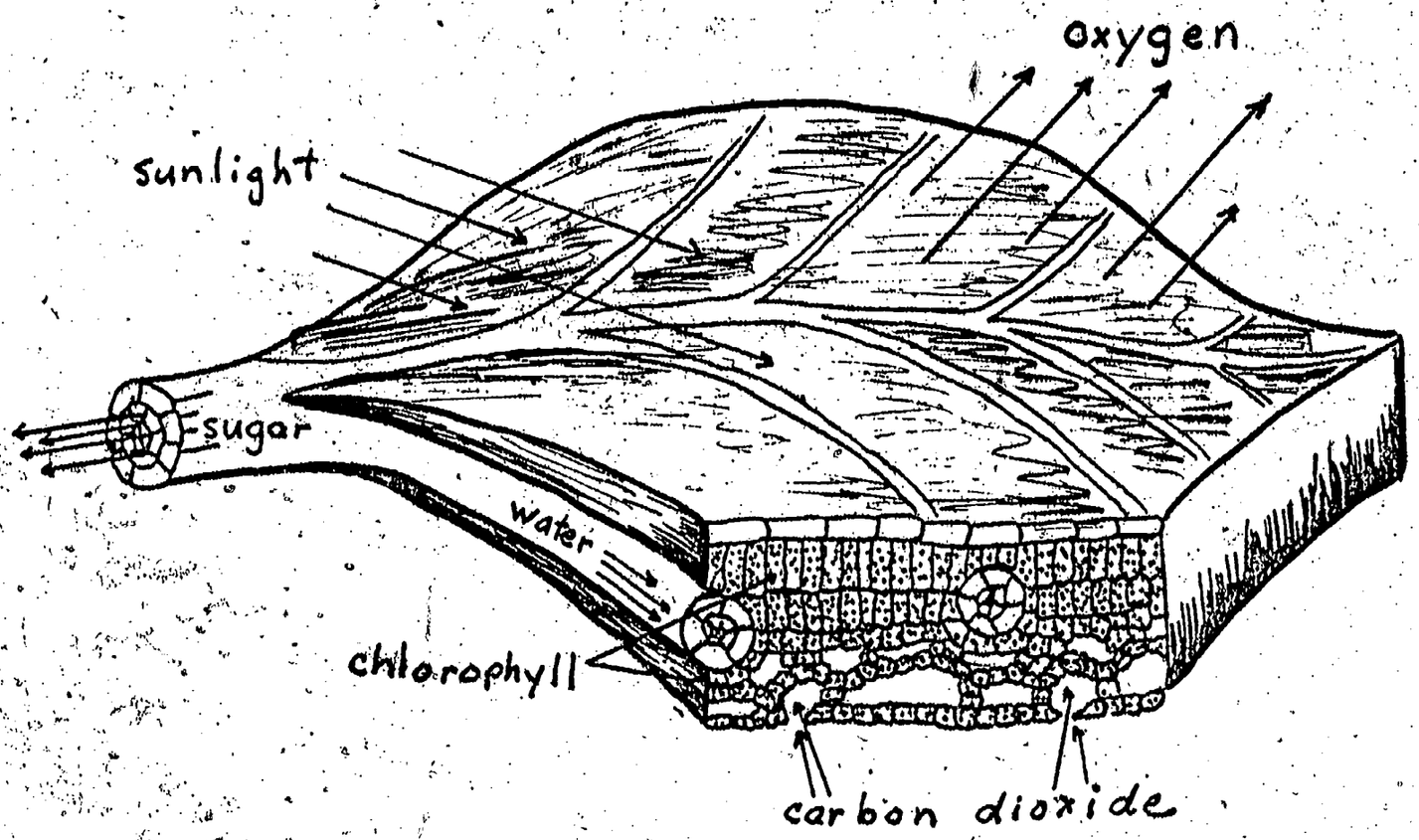
THE LEAF FACTORY

The plant has "factories" where the food is made. The plant food factroies are green and flat, and are called LEAVES. The leaves produce food out of water, minerals and carbon dioxide. A factory must have energy to run its machines. Plants must have energy, too. Plants are made to use the energy from light. Green plants use SUN _ _ _ _ _ _ for the energy to make food.



Have you ever made a building from wooden blocks? You can use the same block to make a different building. The plant uses water, minerals and CO_2 as its building blocks for food sugars.

The plant must have energy to take the water and CO_2 apart into simple units; and energy is needed to build the simple parts again in a different way to make sugar. Plants are able to use the greatest energy source we have --- ___ ___ ___ LIGHT.



The process of food-making by plants is called PHOTOSYNTHESIS. Photosynthesis means putting together with the help of light.

What do plants put together in a new way with the help of light?

1.
2.
3.

PLANTS NEED LIGHT

This may be done at school in groups, or individually at home.

Find an area where several plants of the same variety are growing in the same approximate area. Identify one plant as the "control" plant. Nothing will be done to that plant. Record pertinent information about the "control" plant such as height, number of branches, length of branches, etc. Choose a plant of the same variety to be the "experimental" plant. Record pertinent information.

Using a box tall enough to cover the plant without touching it, cover the "experimental" plant for one half of the daylight hours each day for two weeks. After two weeks compare the two plants and note any differences between them. What are your conclusions?

PLANT NEEDS

You have learned that plants need sunlight, water, oxygen, and minerals in order to grow.

Look around the school yard or your yard at home. Locate all the places where plants do not grow. Determine the reason that particular place will not grow plants. Is it the lack of sunlight, water, oxygen or minerals? It may be due to a combination of missing elements.

Keep a record of your findings.

EXPERIMENTS

Experiment #1

Prove that shade is cooler than direct sunlight. Use thermometers or simply observe.

Experiment #2 - Plants Need Light

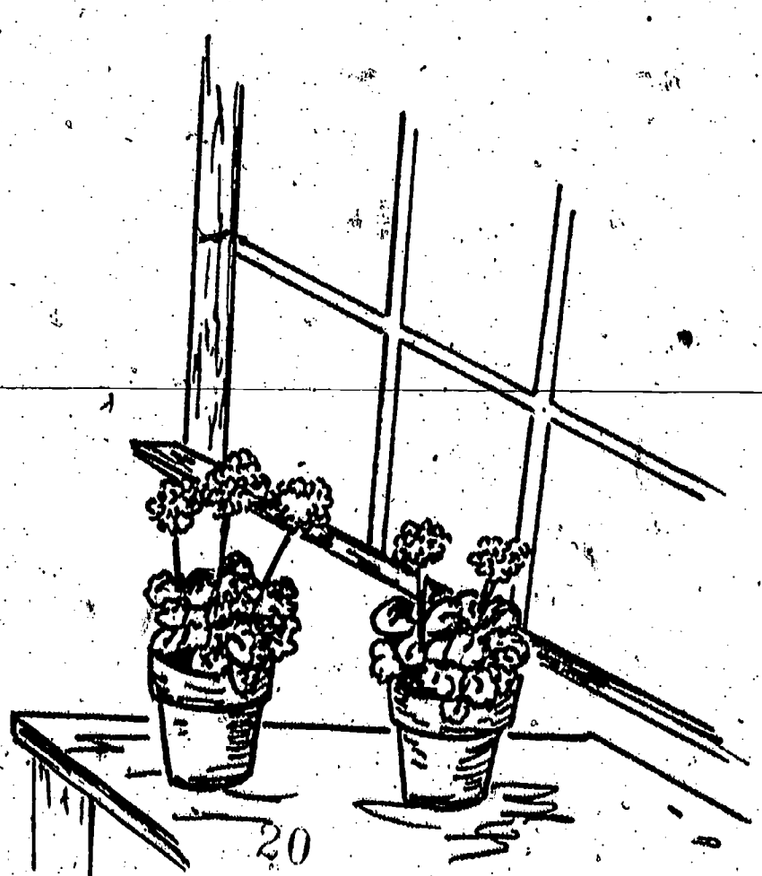
A. Alcohol and chlorophyll - place several leaves in a pan with alcohol. Heat until chlorophyll is removed. Observe the green color. TO BE DONE BY TEACHER ONLY.

B. Board on grass - Place board on grass at beginning of the week. Observe color change in grass after several days.

C. Bag on plant - Cut 2" square hole in a bag; place over plant; put plant on sill; observe direction of plant growth through the opening.

D. Cork on leaf - Use a geranium plant; place 2 pieces of thin cork so that leaf is between. Position with pins. Do not cover entire leaf area with cork. Observe after several days. (Use other opaque material like cardboard if cork is not available.)

E. Plants in sunlight - Put several plants in different positions in the sunlight. Observe for a few days. How do the plants grow? What causes the plants to grow in the direction they do?



Experiment #3 - Plants Need Water and Minerals

A. Water is a dissolver. Place a lump of sugar or salt in water and stir to dissolve. Pour water through a handkerchief stretched over a bowl. Taste to see if solution comes through.

B. Water with minerals is carried up the stem. Break off a celery stalk with a few leaves. Put the stem in water with red vegetable dye. Set in the light for a few hours. Observe the leaves. Break stalks and observe tubes using magnifying glass.

Experiment #4 - Plants Need Carbon Dioxide

A. Vaseline on leaf. Rub vaseline on several geranium leavs, both top and bottom. Tie strings to identify these leaves. Observe and compare these leaves and the others.

FOOD FROM GREEN PLANTS

Make a list of all the different fruits and vegetables that we eat. Sort your list into four groups and continue this table.

FRUITS AND SEEDS	FLOWERS
Oranges	Cauliflower
Peas	

LEAVES	STEMS & ROOTS
Lettuce	Rhubarb
Cabbage	Turnips

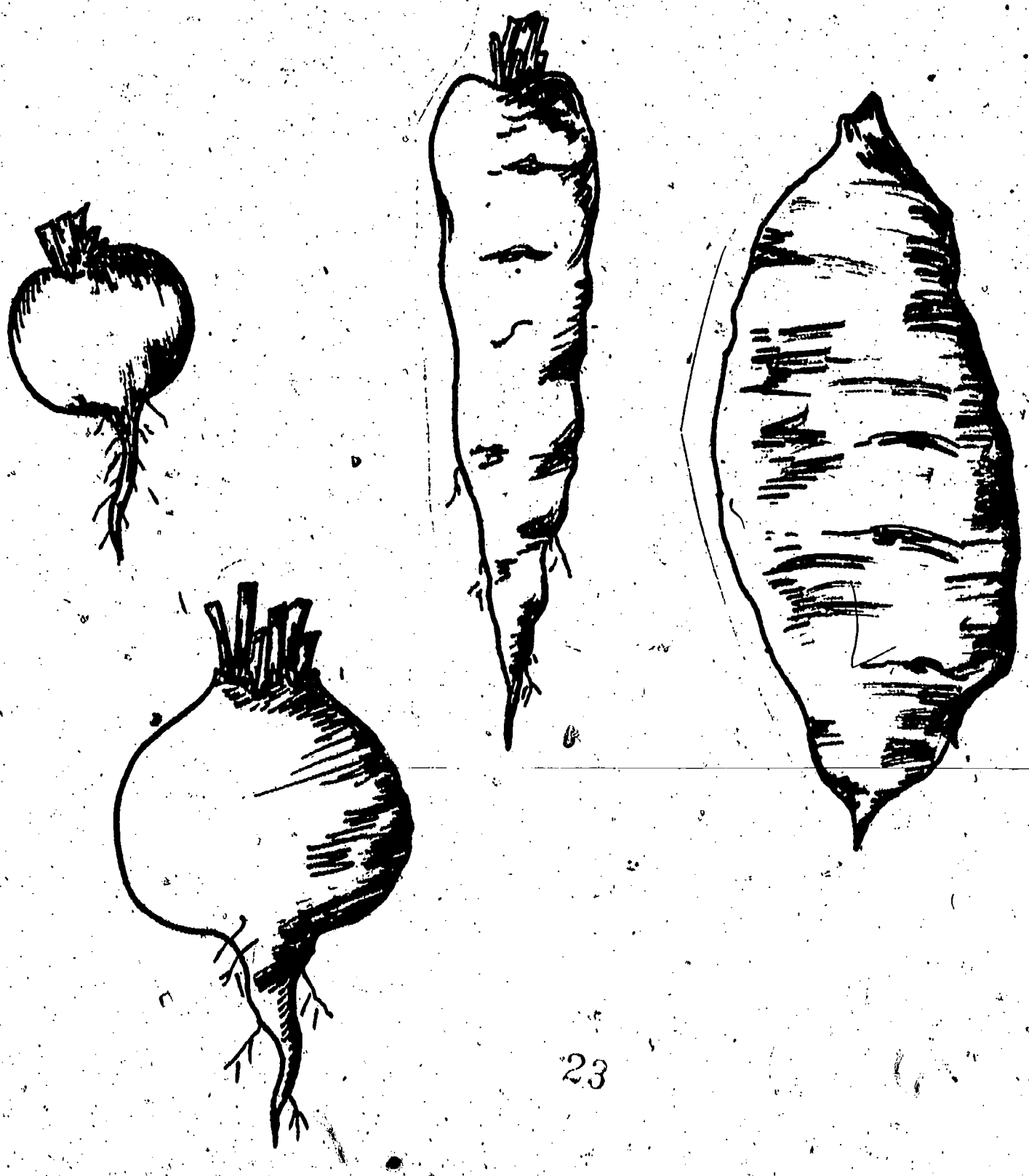
You will see that we eat every part of plants - though not all from the same plant, of course.

In the stems and roots column, you will see that these are not just thin stems or fine roots, but that we eat the stems and roots that are thick and swollen.

This is because the growing plant made more food than it needed and so the food was stored away in the stem or roots. These grew too big to store it all.

That is why such plants are so useful to us, because they contain so much food. This stored food is often starch or sugar. Such stored food gives us energy.

In which ways are these plants alike? How are they used?

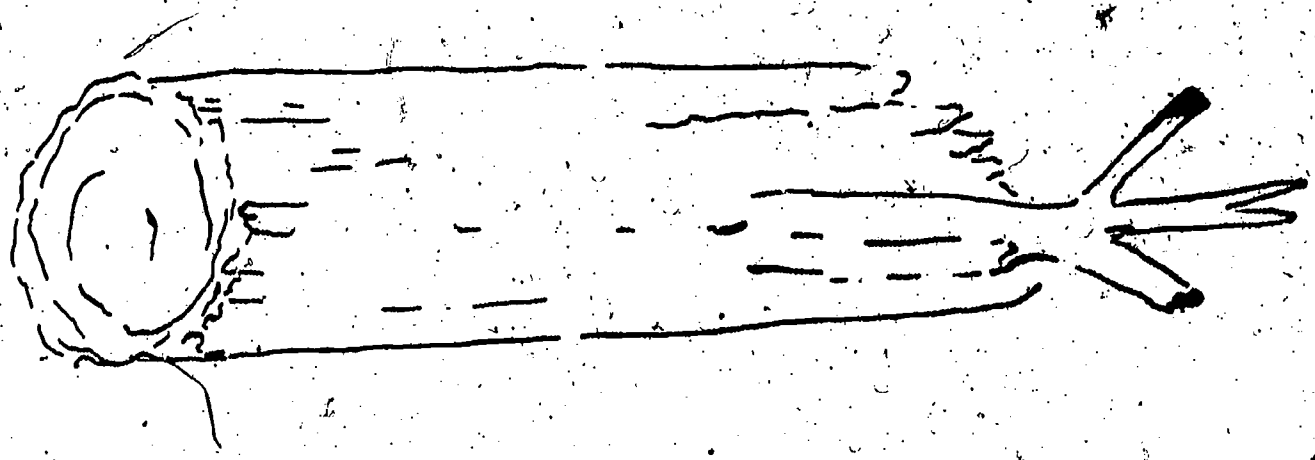


COMMUNITY, NICHE, HABITAT

Many living creatures live together in groups. People live in groups. A group of people which includes mother, father and children is called a family. A number of families make up a larger group called a community. A neighborhood is a small community. A city may be made up of many communities.

All around us there are groups or communities of living creatures. A rotting log is a community. Ants, snails and lizards may live together in the log community. Each creature in the community has an important part. Each plant and animal lives in a certain way. The way of life of a plant or animal is called its niche. Each organism depends on other creatures, each helps other creatures. The shelf fungus gets food from the dead log. It also helps decompose the log. This is the shelf fungus' way of life, or niche. Every creature has an important part, or niche, in the community.

DRAW THE LOG COMMUNITY



The log community is made up of groups of creatures. The log is the home of some of these plants and animals. A creature's home is its habitat. Birds live in trees. Their habitat is the forest. Whales live in the sea. The ocean is their habitat. What is the habitat of an earthworm? Polar Bear? Cattail? Sunflower?

OBSERVATION ACTIVITY

Divide the school yard into areas, such as Oak tree, evergreen shrubs, downspout, tree roots, etc. Assign each student (or group of students) to an area. This will be their area to study and observe. Emphasize the importance of observing, not changing, the area. The students' study of the area may be spread over several weeks, emphasizing a particular thing to be observed each time. A record book should be kept.

1. Draw a map of your area. Mark down the position of trees, grass, shrubs, rocks, flowers, animals, insects, etc.

2. Using a hand lens look for small objects or insects. Try to identify anything you see using books from the library. Describe some of the conditions in your area (dry, sandy, damp, wet, flat, sunny, windy, grassy, etc.)

3. Identify any animals or insects you find in your area. Observe them carefully. Describe their habitat. Describe their niche. Add your observations to your record book.

4. Look for any changes that have happened in your area. Some changes may be sudden and others may take a long time. Keep a chart on changes and their causes. Use the headings DATE, CHANGE AND REASON FOR CHANGE.

L.A.P. THREE
FOOD CHAINS AND WEBS

In nature, each member of the plant and animal community helps another member. The community is in balance. A food chain is one way nature maintains a balanced community.

The food chain begins with a green plant, because only green plants can produce their own food. This process is called _____ synthesis. Plants get the energy to produce food from the sunlight. Plants are called PRODUCERS.

An animal eats, or consumes, the plant. The animal is called a first consumer. Another name for first consumer is HERBIVORE, which means plant-eater. They get their energy from plants, and plants get their energy from _____. Food chains show how energy flows. The arrows show where the energy flows. Name some plant producers. List first consumers of these plants.

PRODUCERS		FIRST CONSUMERS
1.	→	
2.	→	
3.	→	

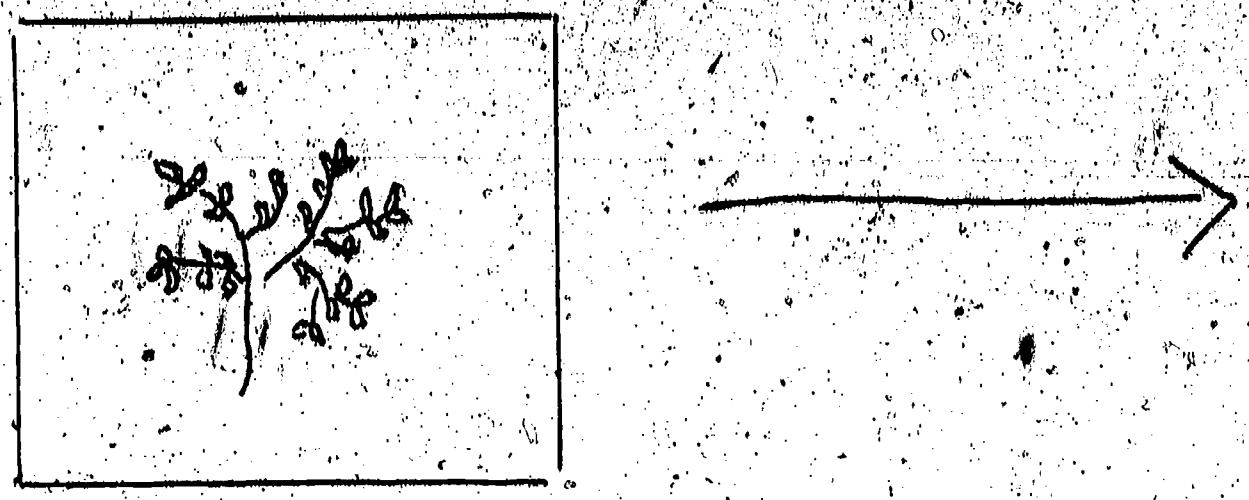
Now we have two links to the food chain. The plant is eaten by the first consumer. Energy flows from the carrot (producer) to the rabbit (first consumer).

The first consumer may be eaten by another animal called the second consumer. Another name for second consumer is CARNIVORE, which means meat eater.

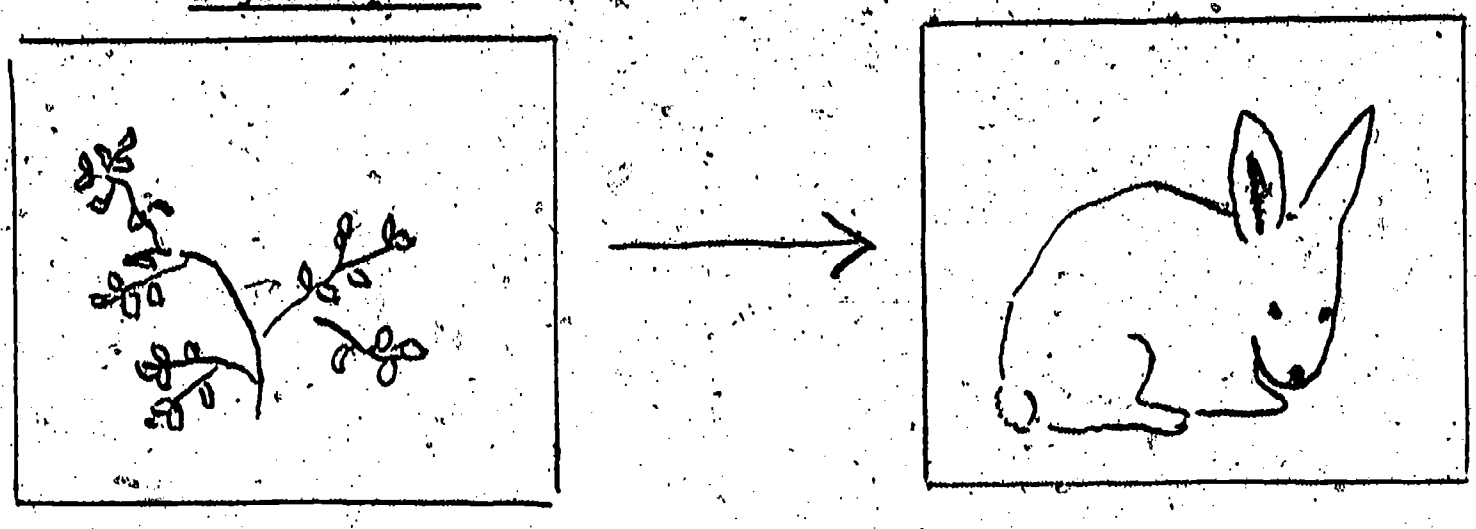
OSPREY

Can you name some second consumers around your school or house? Draw the symbol which means "is eaten by". Now we have 3 links in the food chain.
Remember, the second consumers get their energy from the first consumers. The first consumers get their energy from the producers. The plant producers get their energy from the sun. So, really, the energy we get from food comes first from the sun!

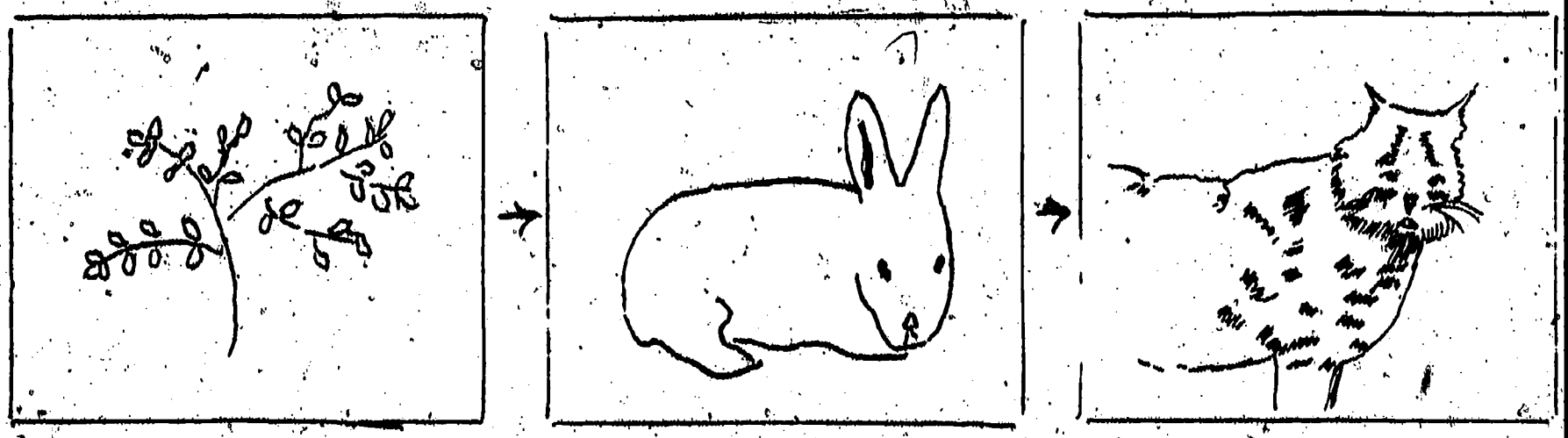
The final links to the food chain are the decomposers. These are the organisms which live on dead, decaying plants and animals. The decomposers break down the dead matter into simple units. Bacteria, molds and mushrooms are decomposers.



To show a food chain, start with the producer, <u>always a green plant</u>.



The plant <u>is eaten by</u> the first consumer.



The first consumer <u>is eaten by</u> the second consumer.

The decomposer is at the end of the chain. Decomposers break down organisms into simpler parts, which go back to the soil.

In nature, food chains are linked.

These are called food webs. We see that each creature may be eaten by several other creatures.

Make a food chain. It must start with a producer. Include first and second consumers and decomposers.

(Activity: Lee County On Campus Teaching Activity Guide, #298 Building a Food Web)

FOOD WEBS

You have learned that green plants are PRODUCERS and that CONSUMERS are all other living things that depend in some way on green plants for food.

On the school grounds observe as many of the major producers, consumers, and decomposers as you can. Write down what you observe in each category.

In the classroom compare your findings with those of your classmates. Construct a food web, using this information, showing the relationship between producers and consumers on the school grounds.

Variations:

1. Collect samples of each, using them to construct a food web.
2. Cut out pictures from magazines and construct a food web.

L.A.P. THREE
ENERGY TRANSFERS

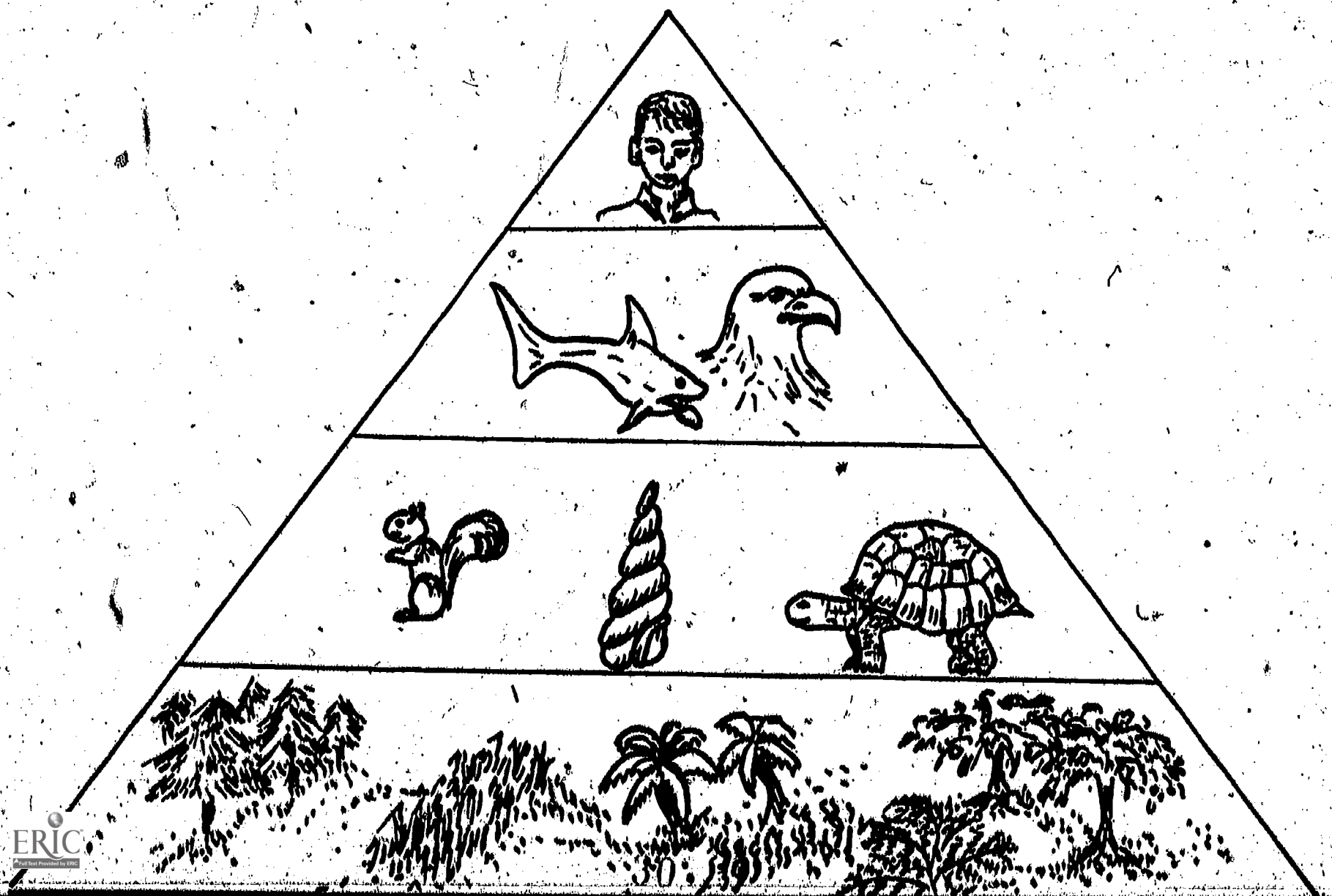
A plant produced its food by using energy from the sun. Then the plant uses some of its food energy to store the food, move water up the stem, and to stay alive.

So, when a first consumer eats the plant, the animal doesn't get all the plants energy, because the plant has already used some energy to live.

The first consumer needs energy to live, too. It must eat many plants to get energy. But the first consumer uses energy to move, breathe, and stay alive.

So, when the second consumer eats the first consumer, the second consumer doesn't get all the energy that the first consumer did when it ate the plant. This is because the first consumer has used energy from the plant to live and move about.

There must be many more producers than first consumers, so that the first consumer can obtain enough energy. There must be more first consumers than second consumers for the same reason.



ENERGY PYRAMID - ACTIVITY

1. Draw a triangle.
2. Make four (4) sections and label.
3. Draw or paste pictures of plants and animals.

ACTIVITY
FOOD TO ITS SOURCES

You have learned that all food energy comes from green plants. Fill in the chart below with as many foods as you can think of. Put the foods we get from animals in one column and the foods we get from plants in the other.

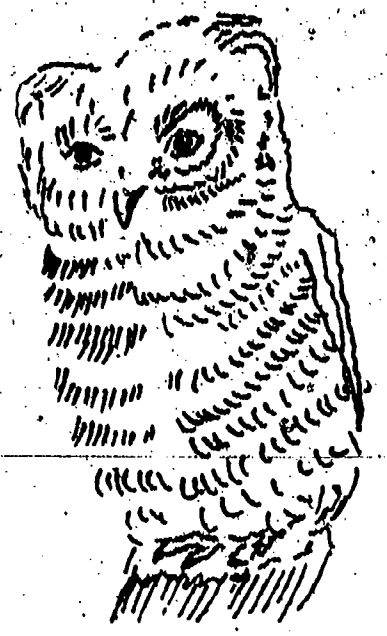
FOODS FROM ANIMALS	FOODS FROM PLANTS

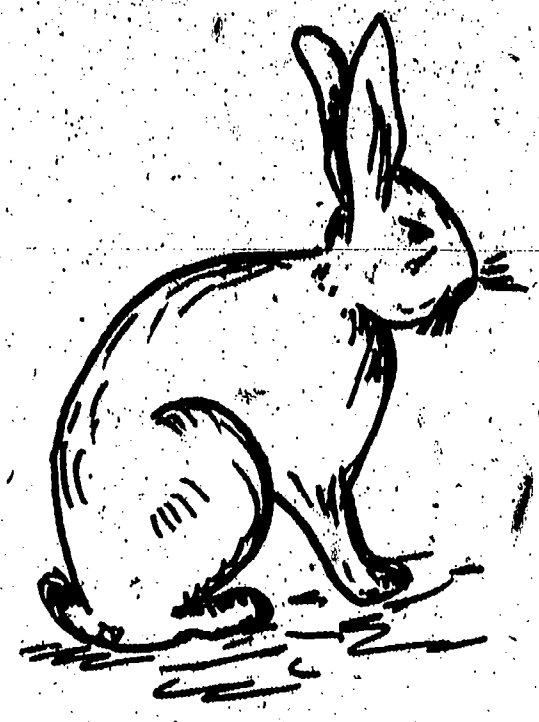
Now look at the list of foods you have written down that come from animals. What animal does each food come from? What does each of the animals eat?

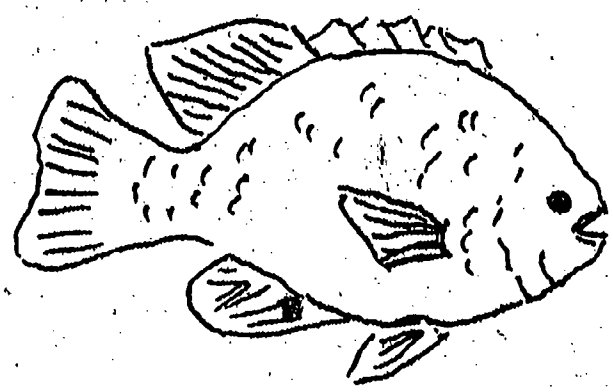
QUESTION: Do all of our foods come from green plants?

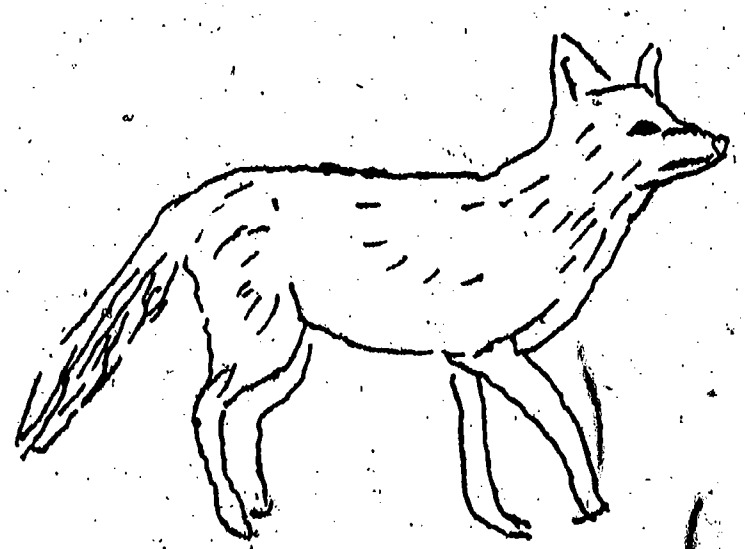
ACTIVITY

All food depends on plants. In the spaces provided below list the foods that each of these animals eat. If the animal eats another animal then list what that animal eats also.





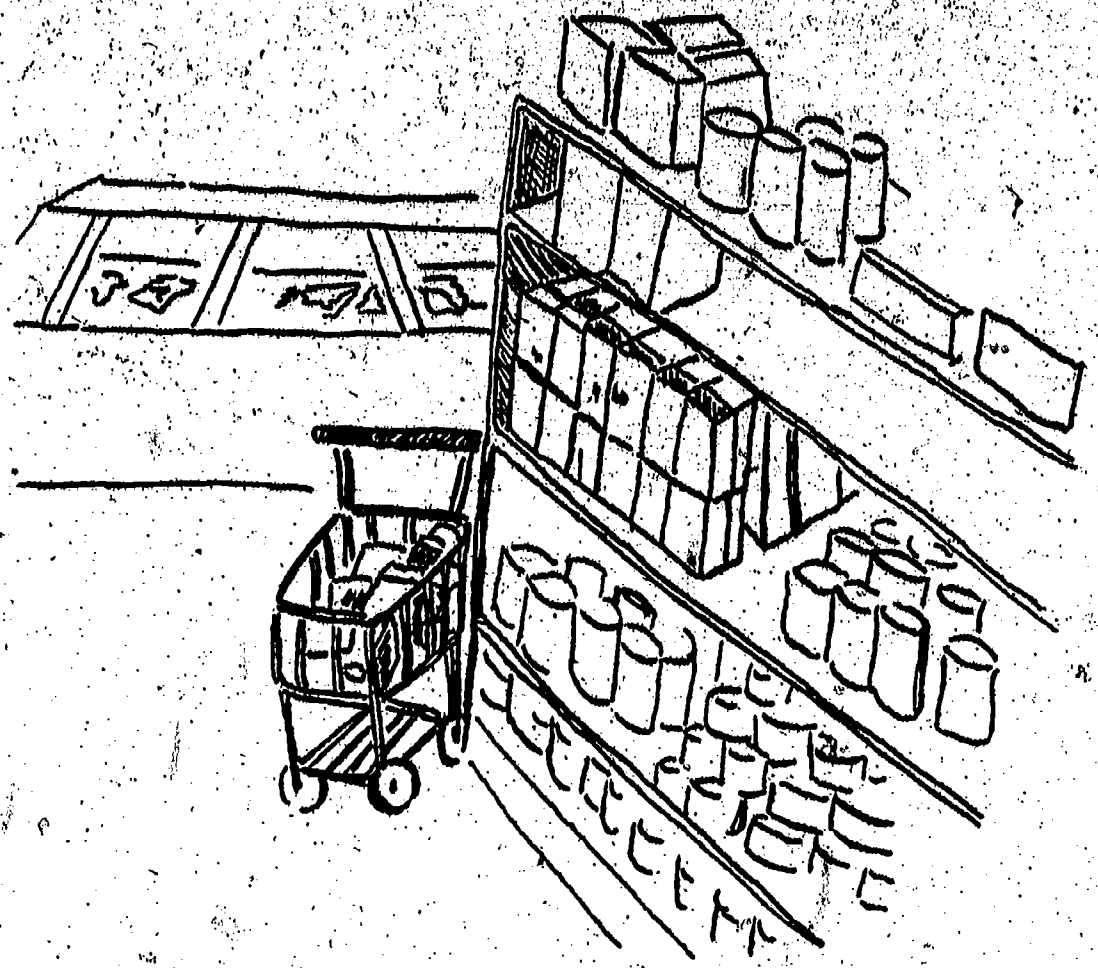




L.A.P. THREE
FOOD INDUSTRY

Green plants are the source of all the food in the world. We can eat some kinds of food, such as fruits, nuts, and many vegetables, just as they are grown.

Cattle, pigs, sheep, chickens, and other animals eat the food that was made in the leaves of green plants. The food they get from plants makes the body tissue that we call meat. Cows also make milk from the green plants they eat. Milk can be made into butter and cheese.

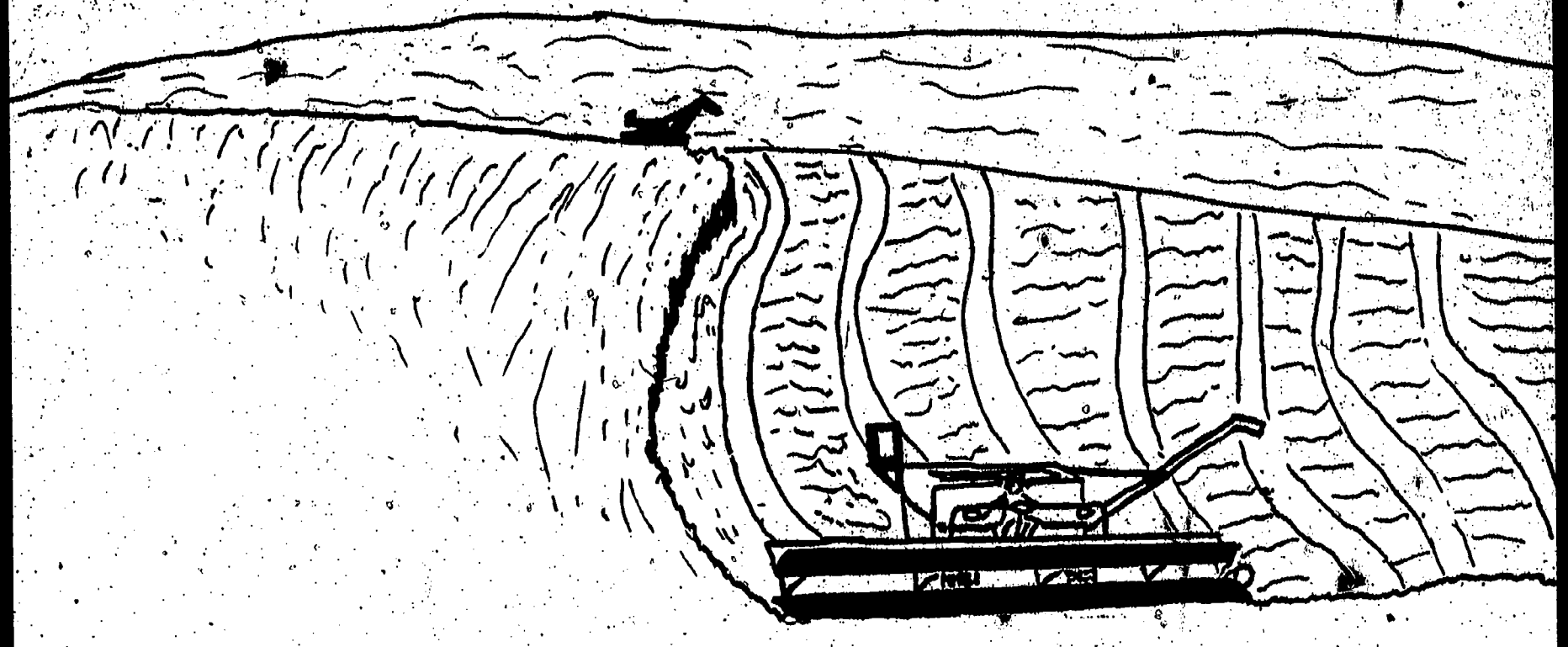


Many foods must be processed before we can eat them. This means they must go through a change before we can eat them. Wheat must be made into flour which is then made into bread. Grains, such as wheat, corn, oats, and rice are used to make cereal. Many foods are canned or frozen before they are sold as food.

Many people work in the food industry. Without them and the important jobs that they do, we would not have the large variety of foods we how have to eat.

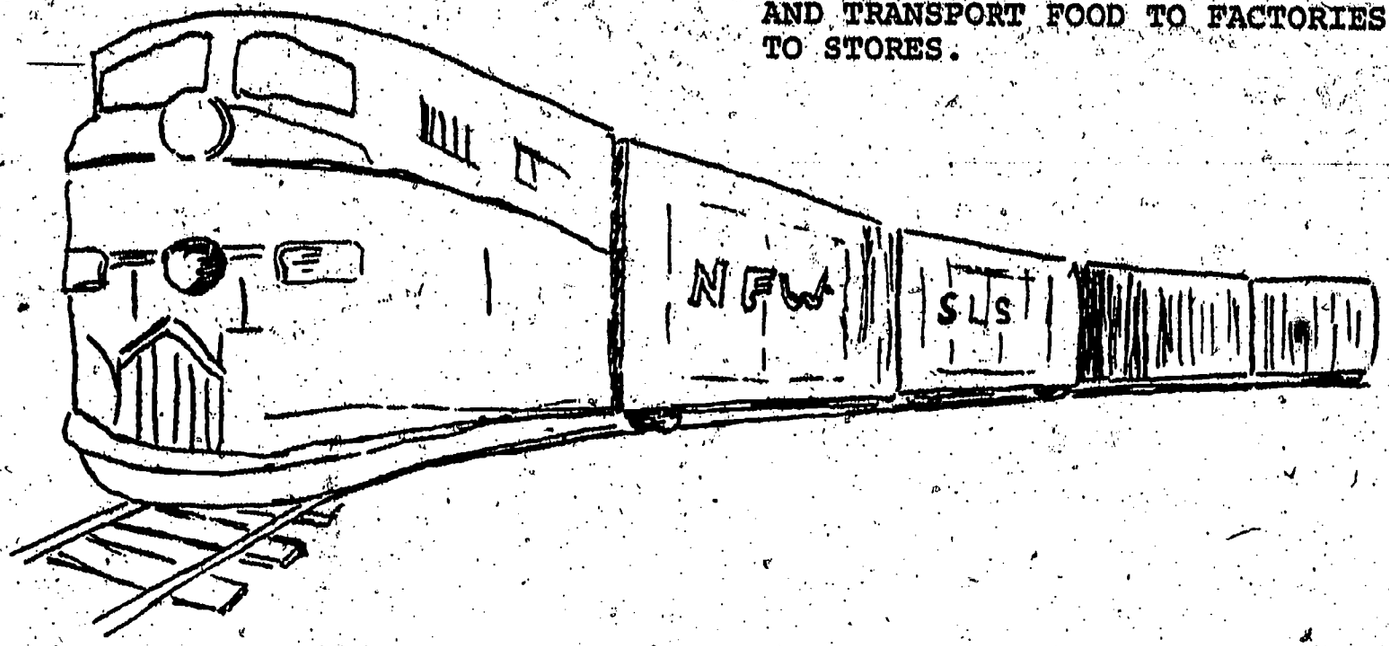
Many different kinds of farmers help us get food. Some farmers grow fruits or vegetables. Others raise cattle, sheep, pigs, and other animals. Some raise cows for milk production. Wheat and other grains are also grown by farmers. Fishermen bring us food from the sea.

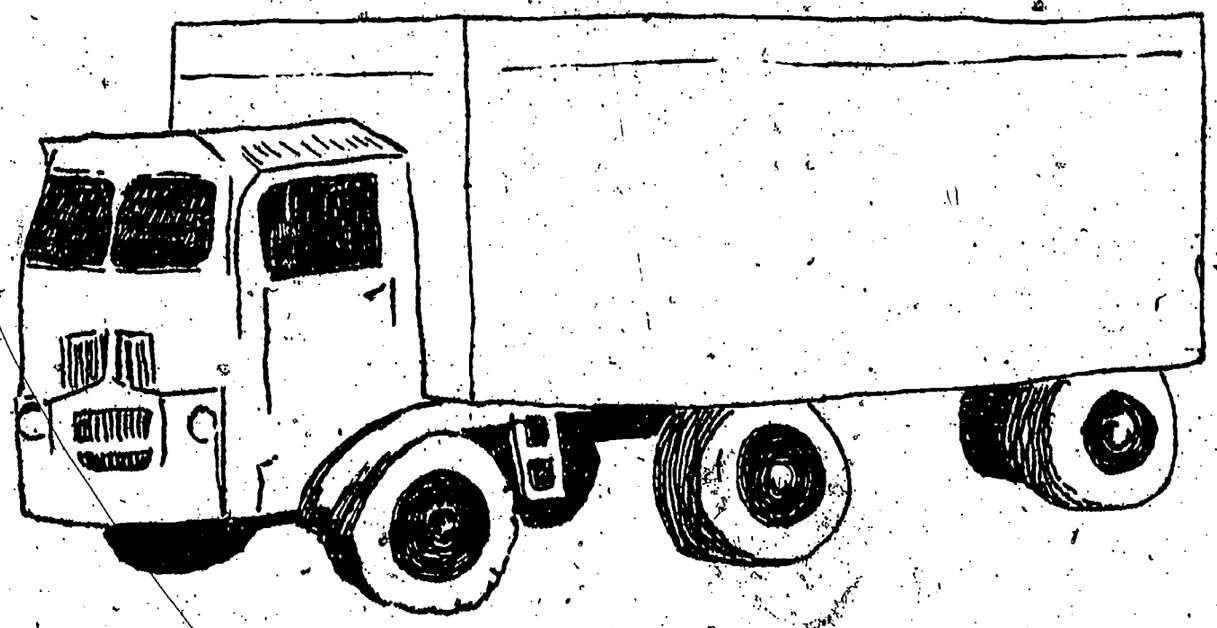
After the various foods have been grown by farmers and their helpers, the foods must be harvested. Some crops, like wheat and corn, are harvested by machine. People are needed to operate the machines. Other crops, such as oranges and tomatoes, need to be picked by hand.



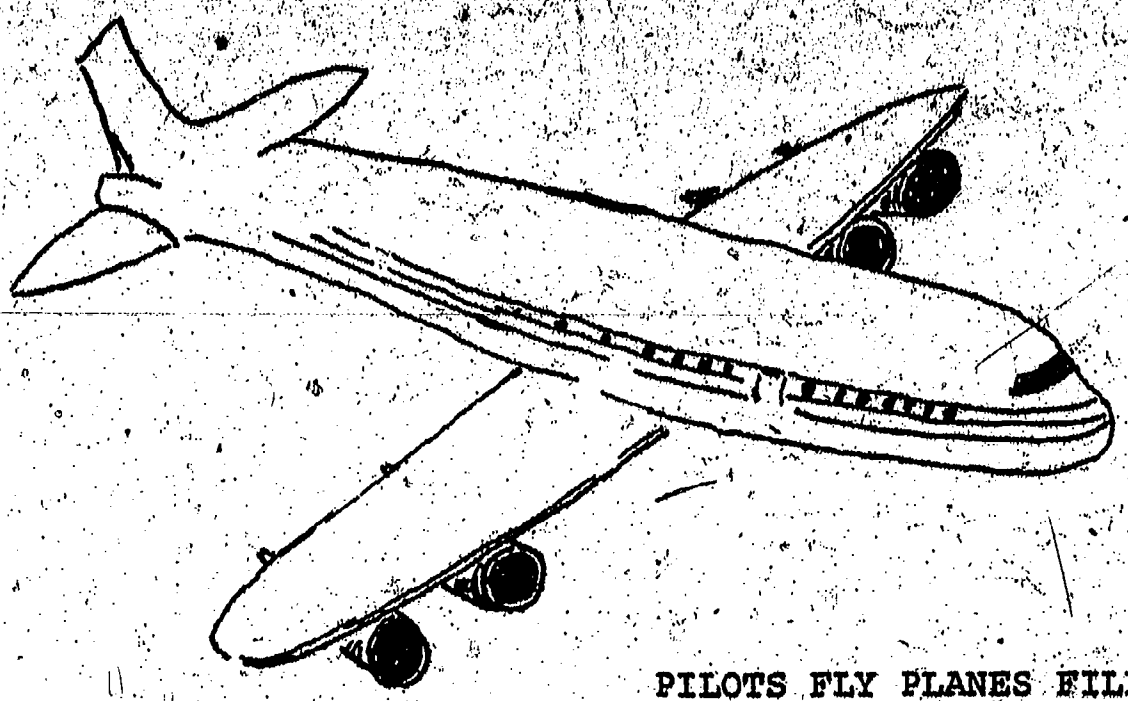
Once the foods have been harvested, they must be transported. Some go to processing plants, while others go directly to stores. There are many transportation workers who work in the food industry.

PEOPLE WHO WORK ON TRAINS HELP LOAD AND TRANSPORT FOOD TO FACTORIES AND TO STORES.

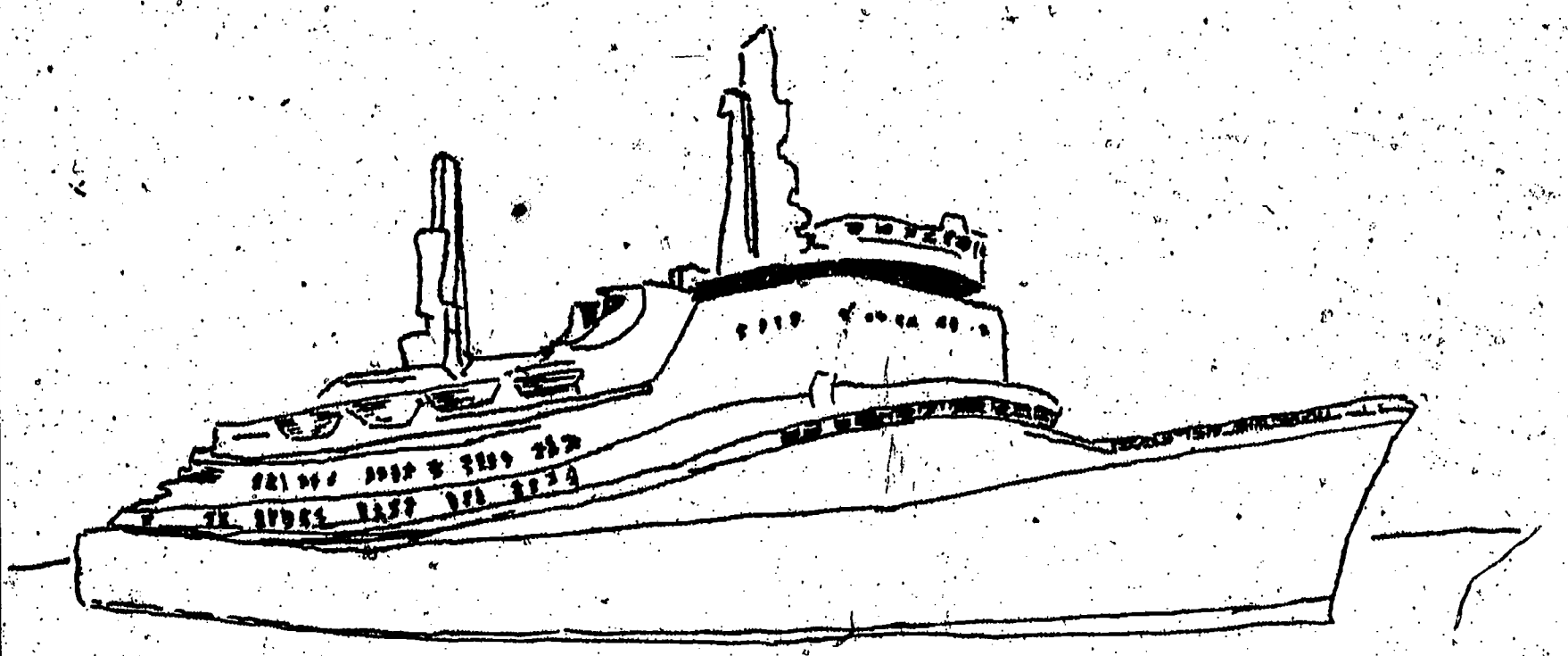




TRUCK DRIVERS CARRY MANY FOODS FROM FARMS TO FACTORIES AND FROM FACTORIES TO STORES.



PILOTS FLY PLANES FILLED WITH FOOD THAT MIGHT SPOIL IF NOT TRANSPORTED QUICKLY.

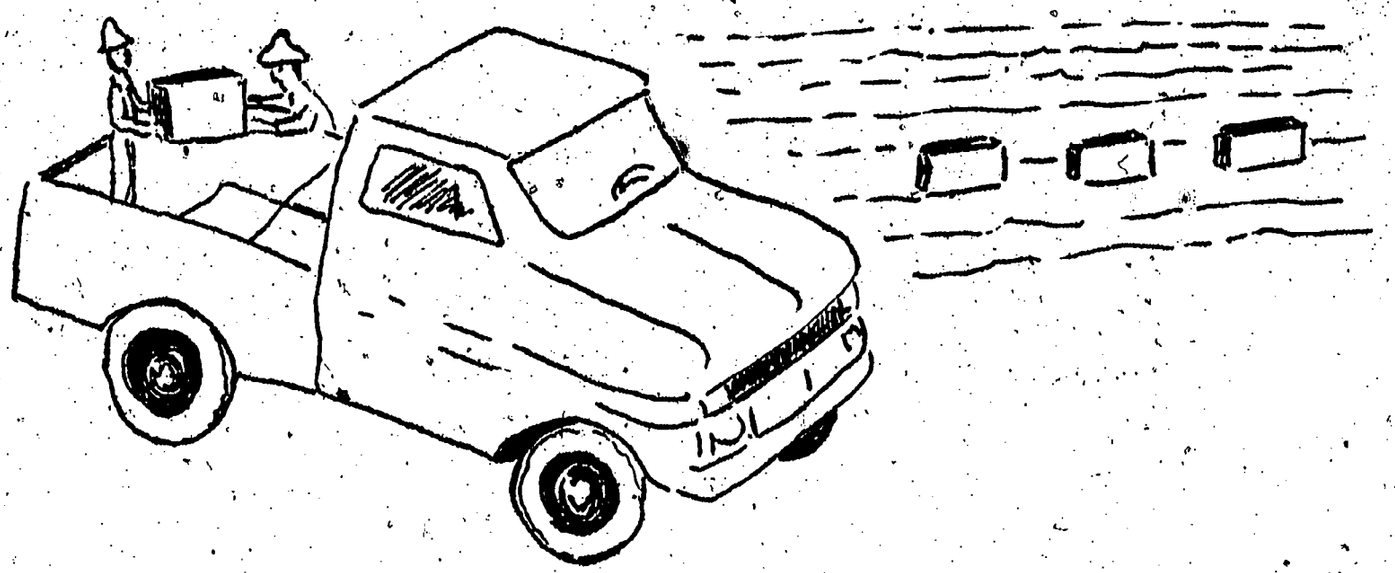


PEOPLE WHO WORK ON BOATS AND SHIPS BRING FOOD FROM OTHER PARTS OF THE WORLD.

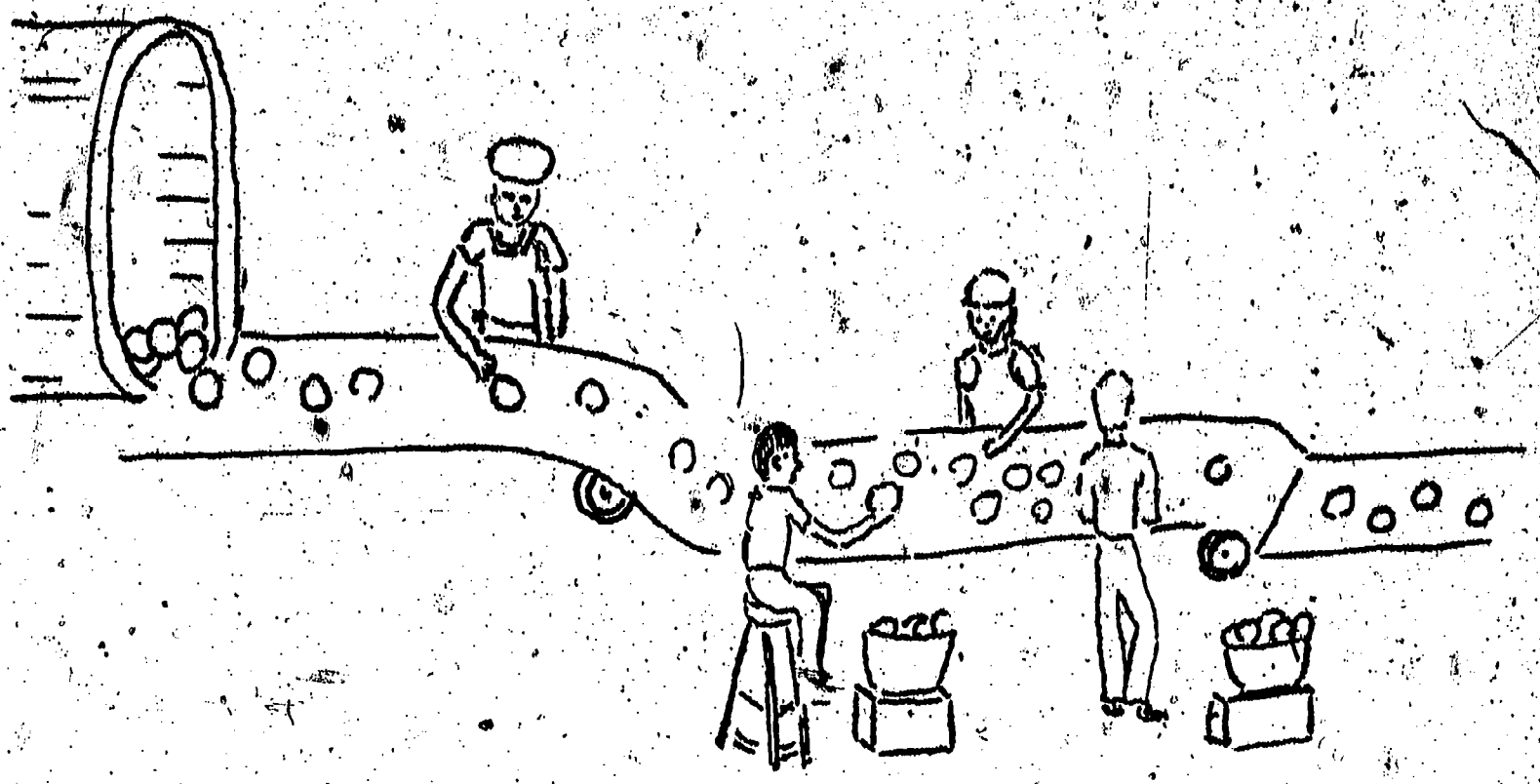
Once foods arrive at the processing plant there are many workers involved in preparing it for market.

Here is an example of the workers involved in canning tomatoes.

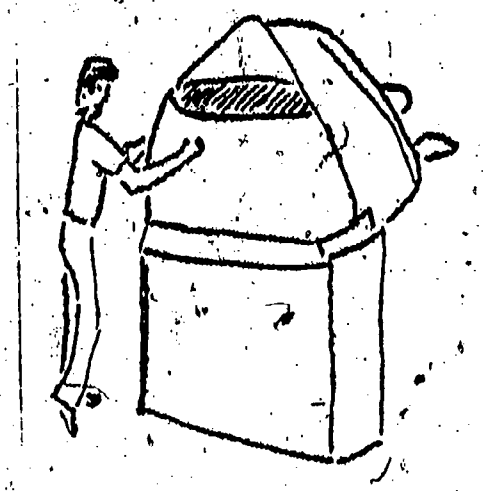
These pickers are harvesting the tomatoes. Some men are loading the tomatoes on a truck. A truck driver will take them to the cannery.



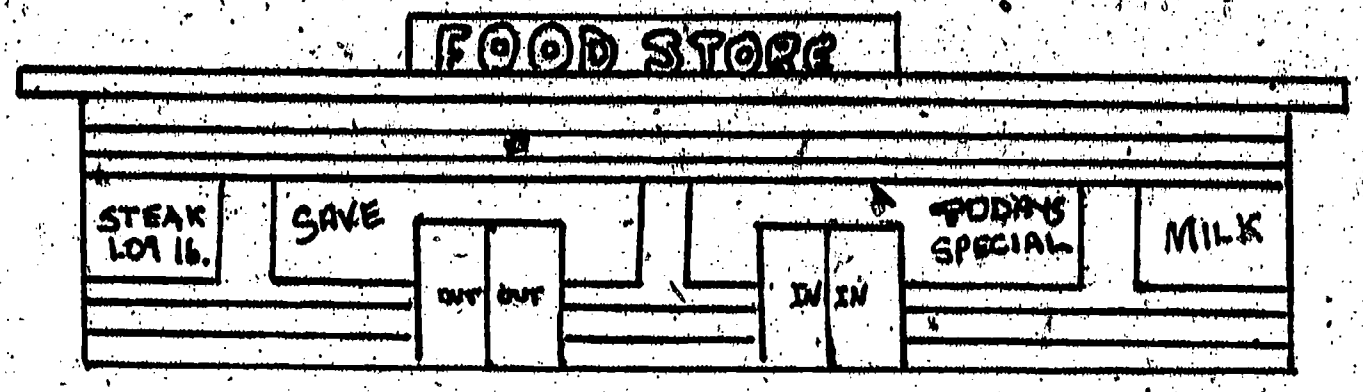
At the factory the tomatoes are put on a conveyor belt. Workers wash, sort, and peel the tomatoes.



One of the workers runs the machine which fills the cans and seals them.



The cans are packed into metal baskets which are lowered into huge cooking machines. They are heated then cooled. Last, they are labled and sent to warehouses and stores.



There are many people who are involved in the selling of food. Large supermarkets employ many workers. See how many you can think of.

Smaller stores may only have a few workers, such as a manager and a few cashiers.

There are also speciality stores, such as meat markets and bakeries where some people work.

List as many stores as you can think of in your area that sell food or things for preparing food.

CAREER FOLLOW-UP

1. Contrast methods of food production in the past and present.

2. Contrast methods of producing the same food in different parts of the world. (Example - breadmaking)

3. Make a report (either written or pictorial) on the travels of a certain food from where it is grown to the time it is bought. (Examples - orange, wheat, peanut, potato chip, etc.)

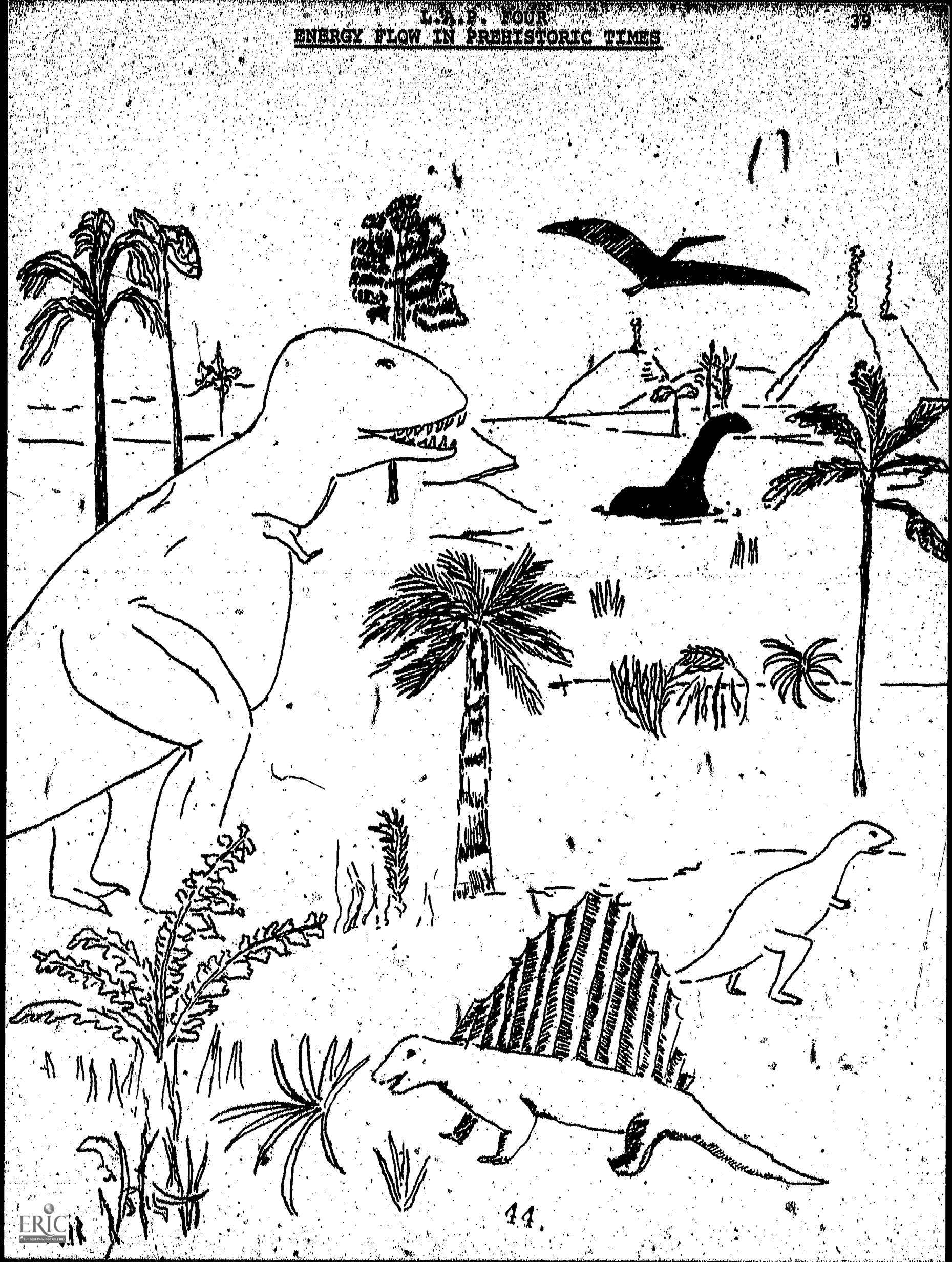
4. Interview several food industry workers. Report to the class.

5. Report on a food processing plant in your area.

6. Find out which foods are grown and processed in Florida.

7. Find out which foods are grown and processed in your country.

ENERGY FLOW IN PREHISTORIC TIMES



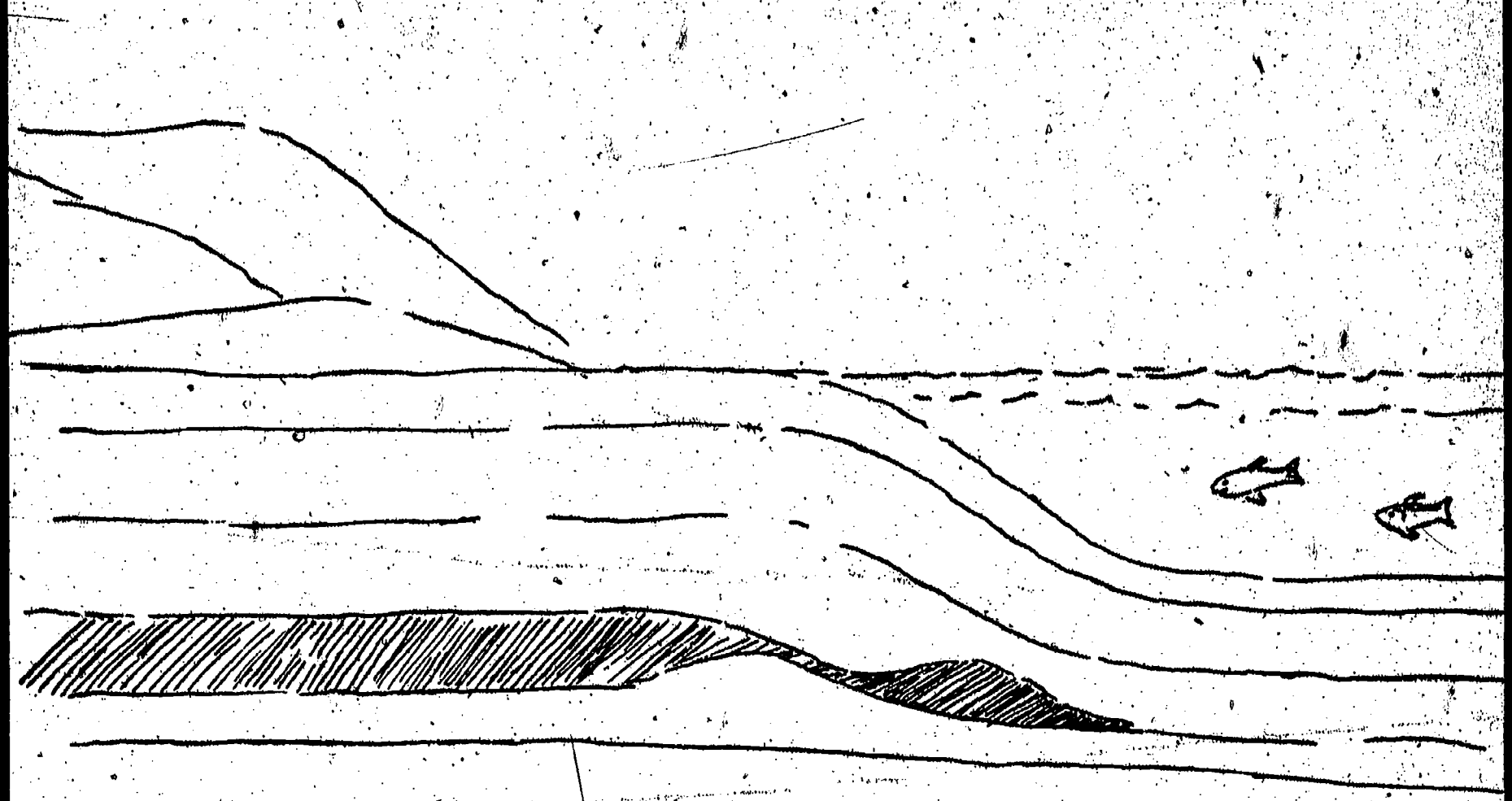
A long time ago - long before there were any people, the Earth was made of warm seas and thick jungle. The climate was much hotter than it is now. Plants and trees grew where the North and South Poles are now.

Dinosaurs lived in the jungles. They were very big, a lot bigger than elephants. They were so big that the ground shook when they walked. In the warm seas, there lived other strange creatures.

In those days it rained almost all the time. There were bad earthquakes and volcano eruptions. Sometimes the ground would split open or move slowly up and down. Mountains would come up in one place. At another place the land would sink into the water. Every time the land sank in the sea, the jungle and animals growing or living on it would drown. Then layers of sand and mud from rivers would bury the dead things. In some places the land shifted so many times that dozens of layers of sand and mud (called SEDIMENT) covered the dead things.

The weight of the S _____ on top of each other caused it to turn to stone. After that the dead plants and animals that were buried in the stone were changed into OIL, COAL and NATURAL GAS. Today, those FOSSIL FUELS are still locked in the pores of some rocks.

LAYERS OF SEDIMENT



Layers of Sediment Activity: To make your very own model of rock layers do this:

1. Get a clear jar and 4 or 5 paper cups.
2. In each cup collect a different color of sand or dirt.
3. Fill the jar ¼ full with water.
4. Now, one at a time put a cup of your different colored sand into the jar.
5. When the water clears, you should be able to see the layers of S _ _ _ _ _ _ _ on top of each other.

(This activity from Phillips Petroleum Company)

L.A.P. FOUR
FOSSIL FUEL FORMATION

Remember that the Fossil Fuels (Coal, Oil and Natural Gas) were locked in the pores of some rock. Now, let's read how the Fossil Fuels (Coal, Oil and Natural Gas) are formed.

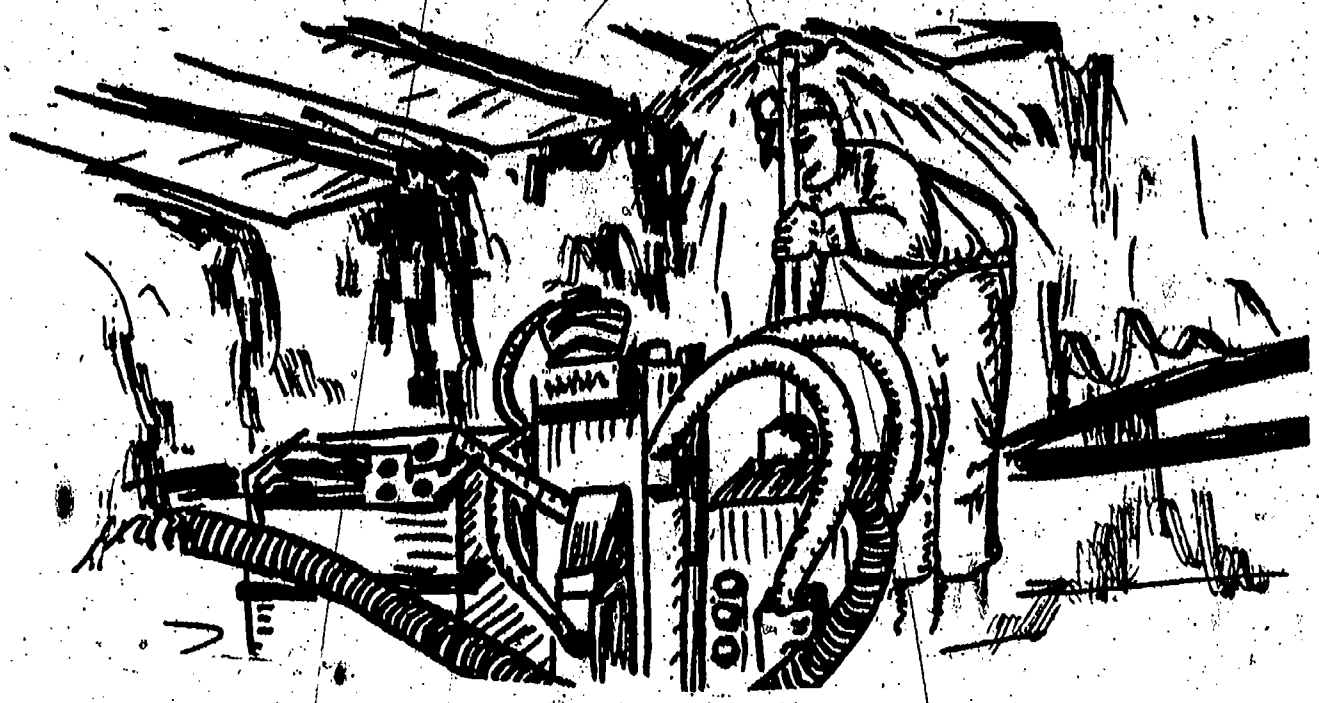
COAL FORMATION

The Earth looked different 300 million years ago. Many plants that we know today were not growing then. In low swampy forests many trees had fern-like leaves. Ferns were also living as were trees which look something like pine and fir. One difference is in the leaves. Millions of years ago, the leaves were three or four feet long and about two inches wide. We know what these plants looked like because they left fossil imprints in the coal.

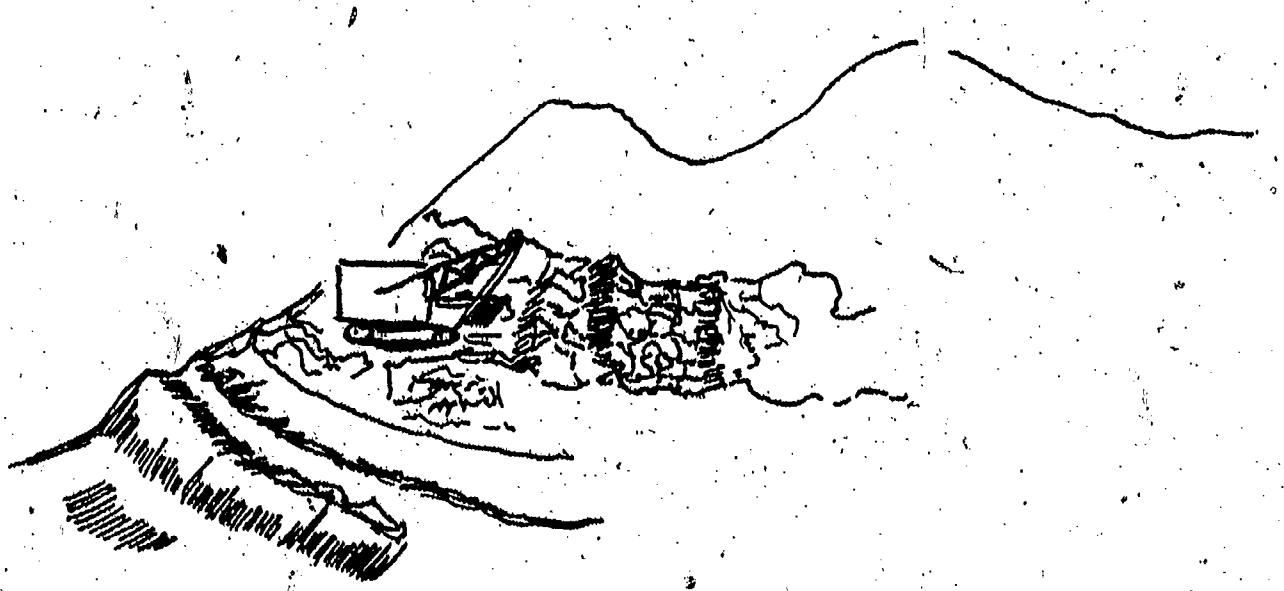
The weather was warm and wet. A great part of where the Eastern United States is now, was like the Everglades. The ground was low, swampy with the fern-like trees, ferns and other trees. The woody material fell and became water-logged. Peat was formed. Peat is the first stage of the making of coal. Peat is being formed today. If it is covered over in sand and shale, it could be coal a few million years from now.

The plants got energy to grow from the sun. The energy was stored in the leaves and wood of the trees. It did not rot because it was covered over with sand and rock. Not enough air was under the layers of rock to cause decay. The wood and leaves left large amounts of carbon.

Some coal is deep under many layers of different kinds of rock. Men must dig many feet into the earth to bring out the coal. This is called a coal mine. The men are miners. The men go into tunnels called shafts. There are little hand railroads under the ground to bring the coal to the main shaft. Fresh air is pumped into the shafts so the miners can breathe fresh air. Many things have to be done to the shafts to make them safe for men to work. Sometimes, however, a change in the earth will cause a shaft to fall.



Another type of coal mine is on the top of the earth where coal is near the earth's surface. This is called a STRIP MINE. Using bulldozers and other heavy machines, the rock is scraped away leaving the coal to be collected by machines.



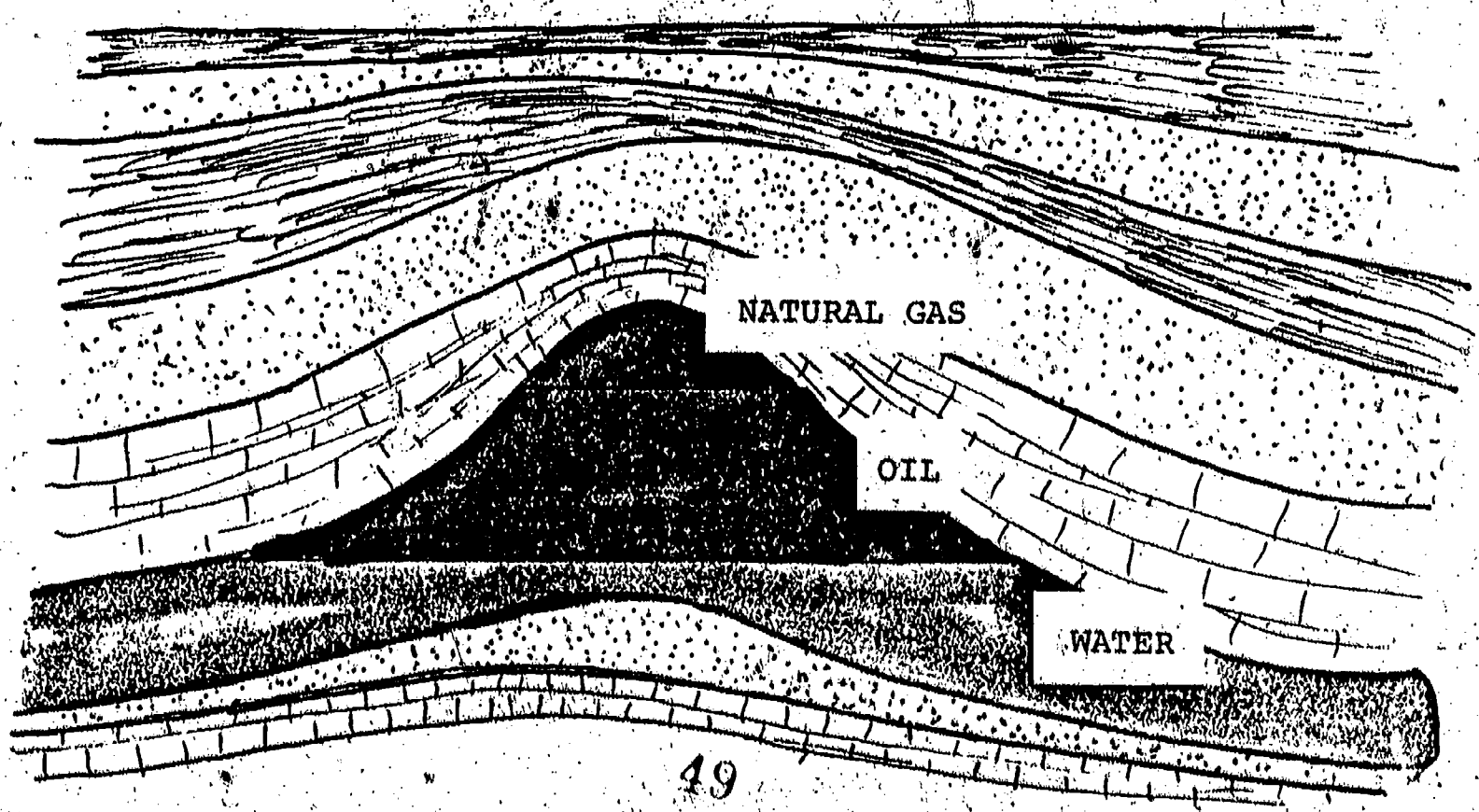
The main coal producing states are Pennsylvania, Ohio, Virginia, West Virginia, Kentucky and Illinois.

Coal has other uses besides burning as fuel. Tar, a sticky dark liquid is made from the gasses given off when coal is heated. Many medicines, dyes, explosives and paint thinner are made with tar.

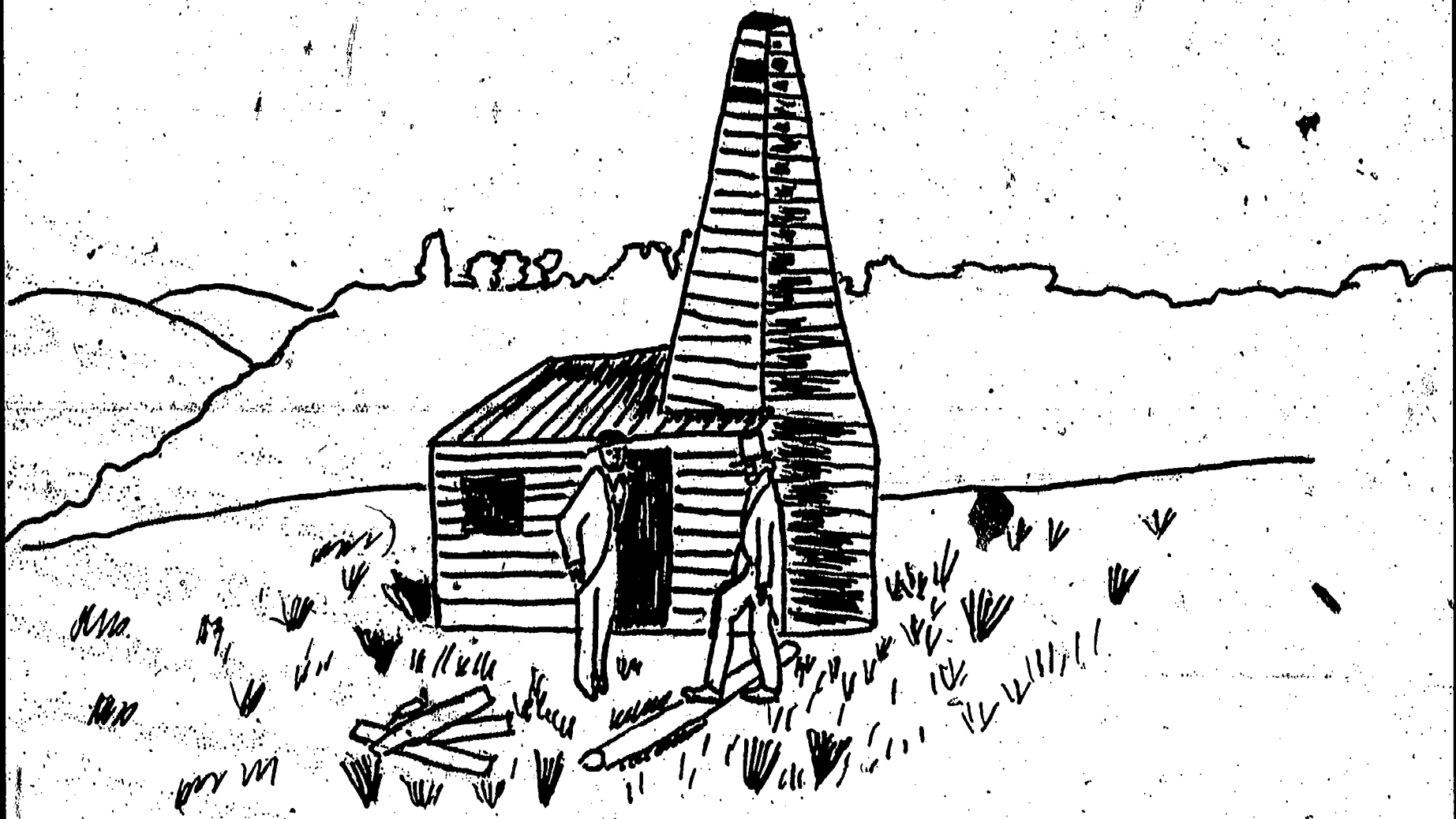
OIL AND NATURAL GAS FORMATION

Seas were near that swamp of long ago. Lots of little plants and animals lived in those seas. The plants got energy from the sun. The little animals ate the plants and each other. Something happened to these seas. The little plants and animals died. Sand, rock and soil covered the sea so it was no longer a sea. Heat from the earth and the heavy dirt and rocks worked on the dead plants and animals. These water plants and animals turned into oil. Natural gas rose from the oil. The gas was trapped between the oil on the bottom and rock on top.

After millions of years, these once living plants and animals help us live better. Most of the natural gas in North America is found in Louisiana, Texas and Oklahoma, and it is pumped through pipes to cities. It is then piped to homes for heating and cooking.



Under the natural gas is the most used fossil fuel. We use it to get to school. We use it on our machines. Oil is the fuel people are looking for all over the world. The first oil well was dug in 1859 in Pennsylvania. Oil is now being pumped from Alaska to the Gulf of Mexico.



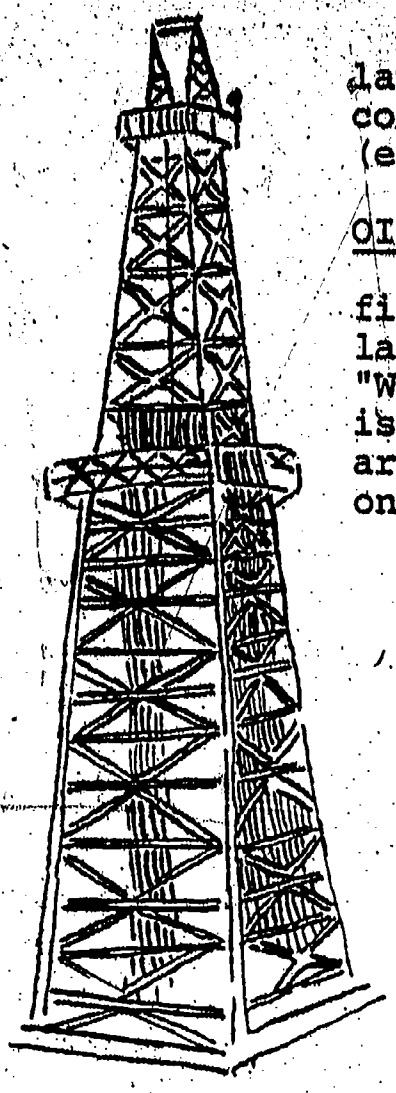
When oil comes from the ground it is called crude oil. It cannot be used in our cars or jets as crude oil. It is sent to a refinery. At the refinery, it is changed to many products.

The fossil fuels are C __ __ __, O __ __, AND N __ __ __ __ __ G __ __. Do you remember how they were formed?

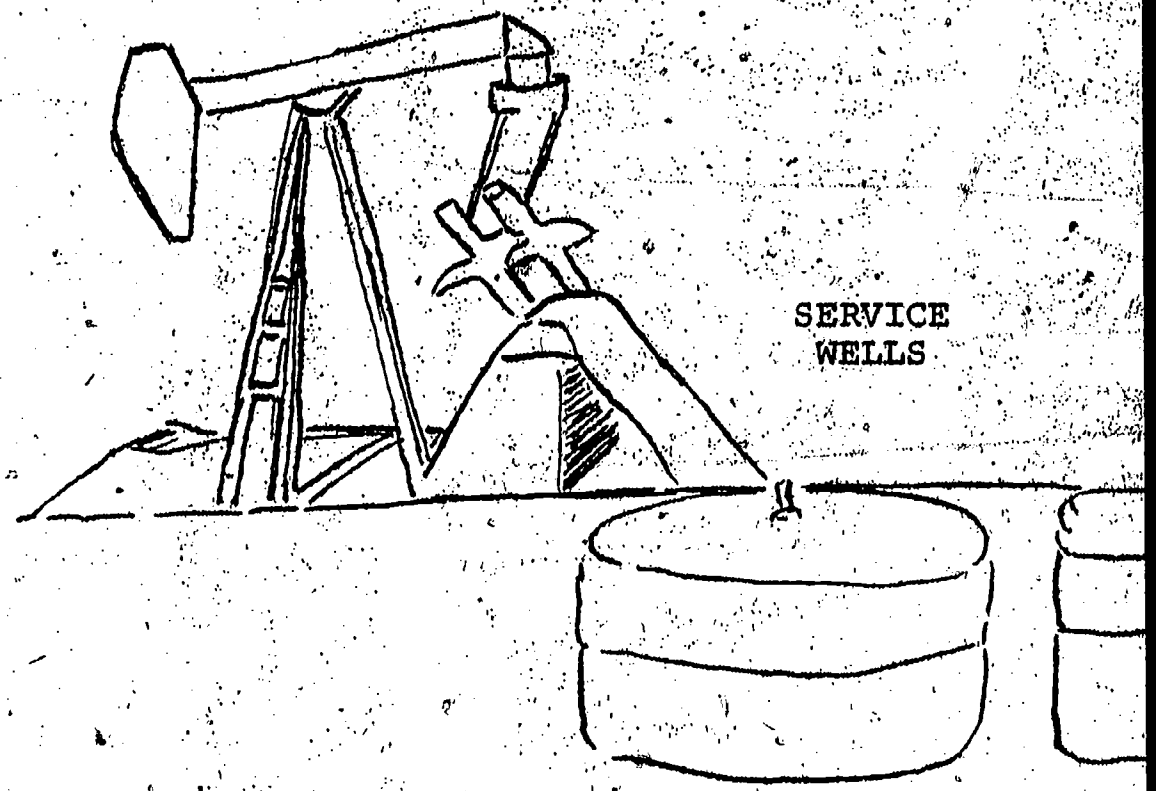
How do men get FOSSIL FUELS out of all those layers of rock? In this unit we will find out how coal, oil and natural gas is brought to the surface (extracted) and used (processed).

OIL AND NATURAL GAS

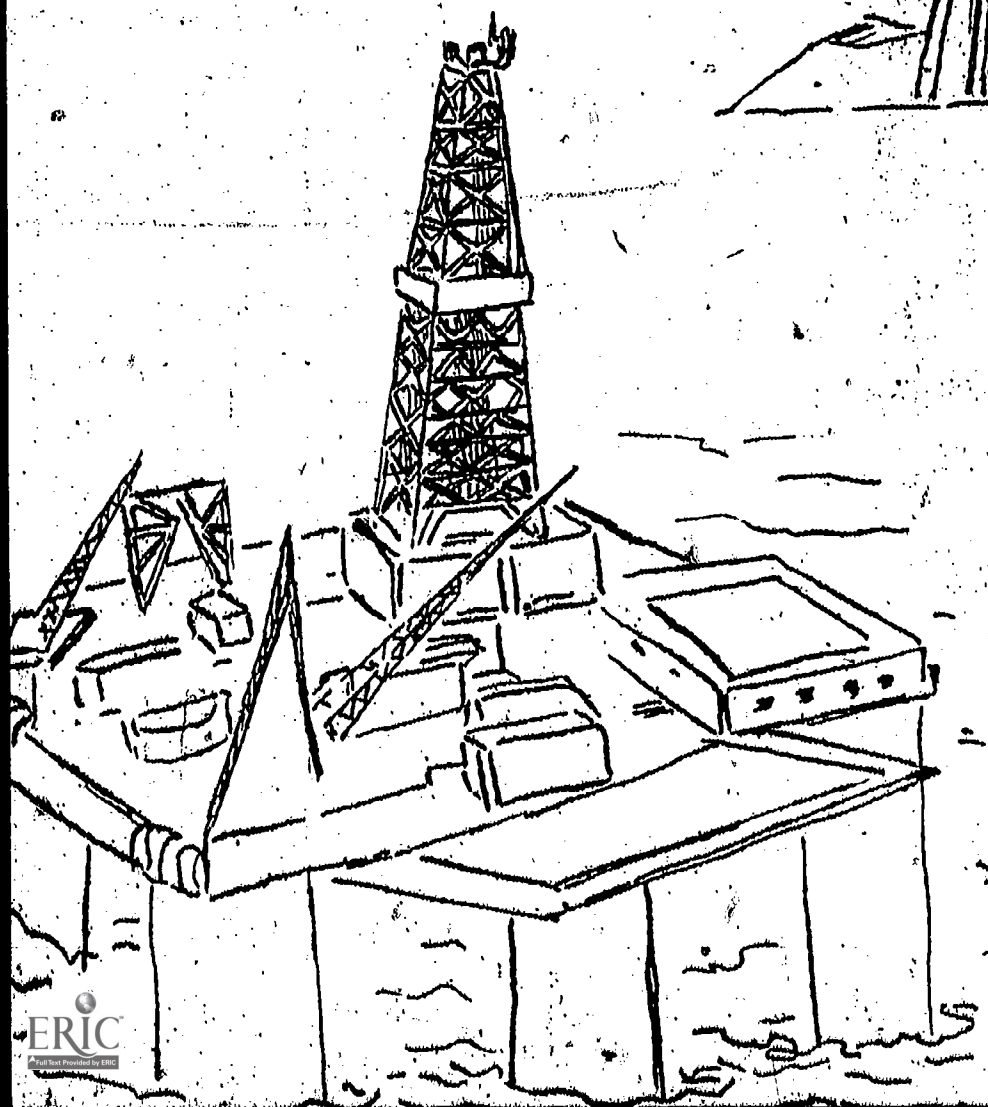
To extract and process these FOSSIL FUELS men first have to FIND it. Remember, the fuels are under layers of sand, soil and rock. They find it by "Wild Catting" or scientific methods. Wildcatting is when they just make a WELL and DRILL. Some wells are 4 to 5 miles deep. It takes from one month to one year to drill.



DEVELOPMENT WELLS



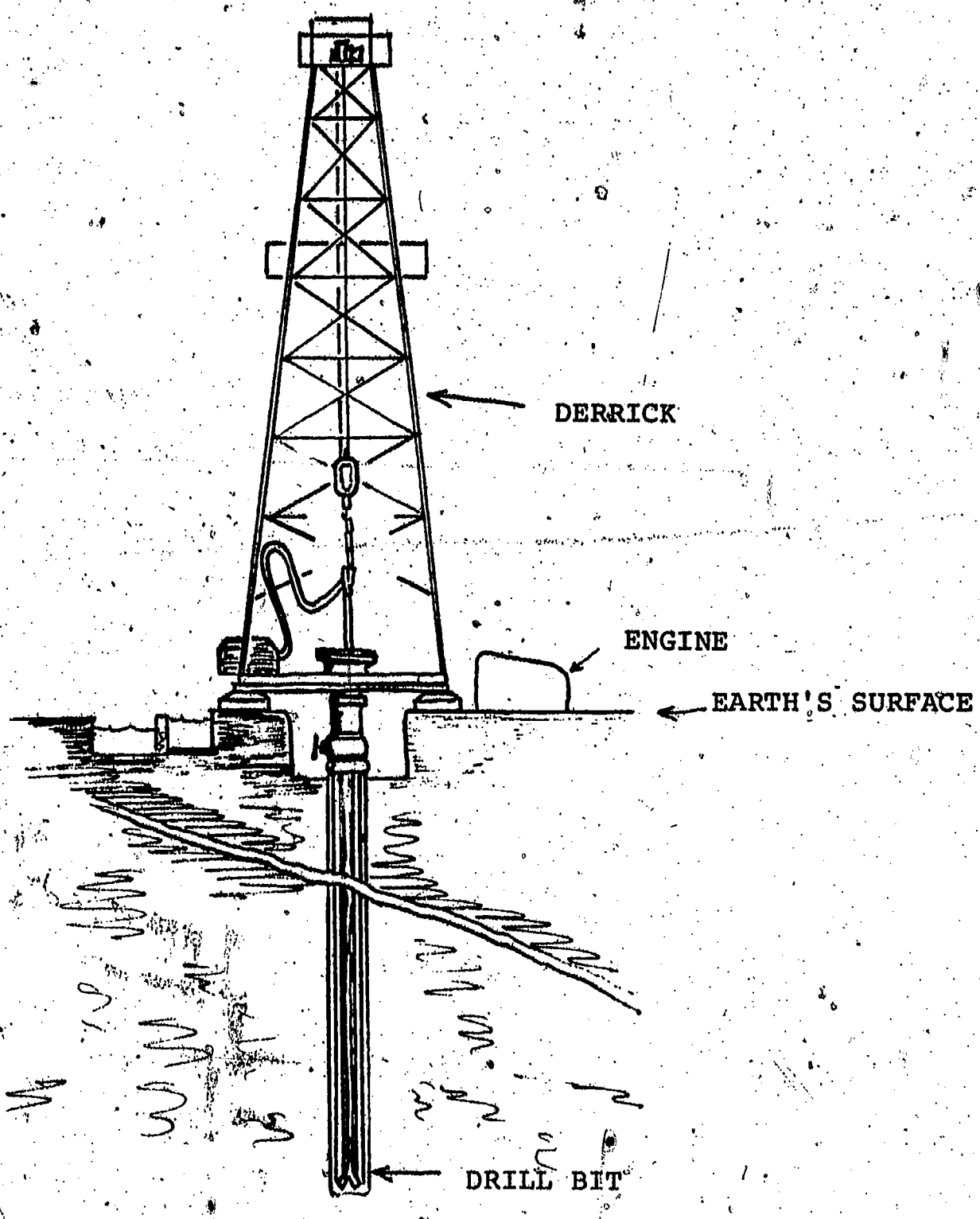
SERVICE WELLS



OFFSHORE WELLS

Many people do different jobs to find oil. After it is found, a well must be built. Digging the well is hard work. Pumping the oil to the refinery is another job. People work in the refinery keeping the machines repaired. The products must be delivered all over the world. Trains, trucks, ships, and jets carry the oil products to the people. Many people work to sell the oil products. You may know someone who sells something made from oil.

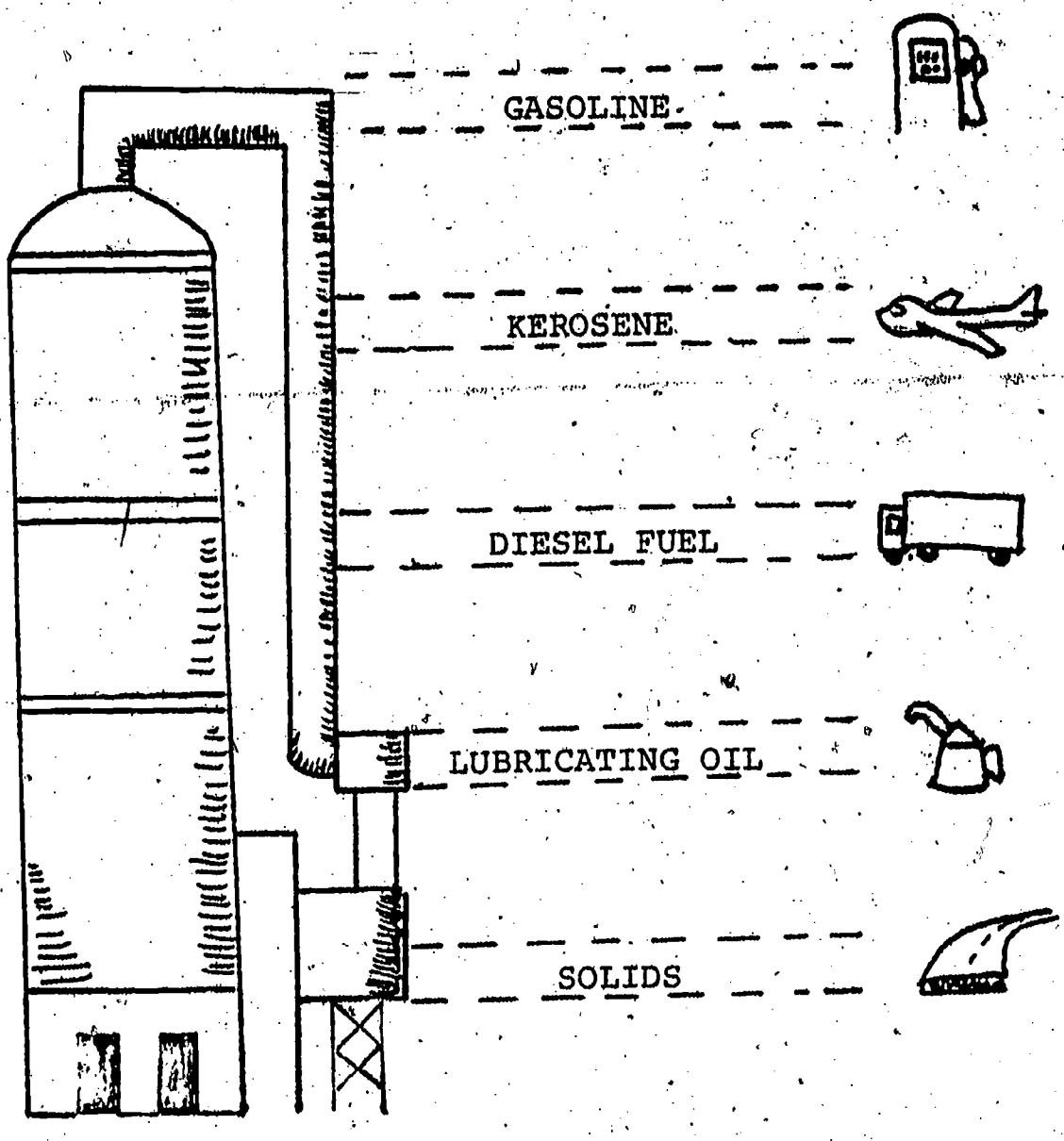
OIL WELL



Look at the chart of petroleum products on the bottom of this page.

The oil and natural gas are processed by DISTILLATION. (That means the crude oil is heated.) The oil turns into VAPORS. The vapors change into gasoline, kerosene, oil and other products.

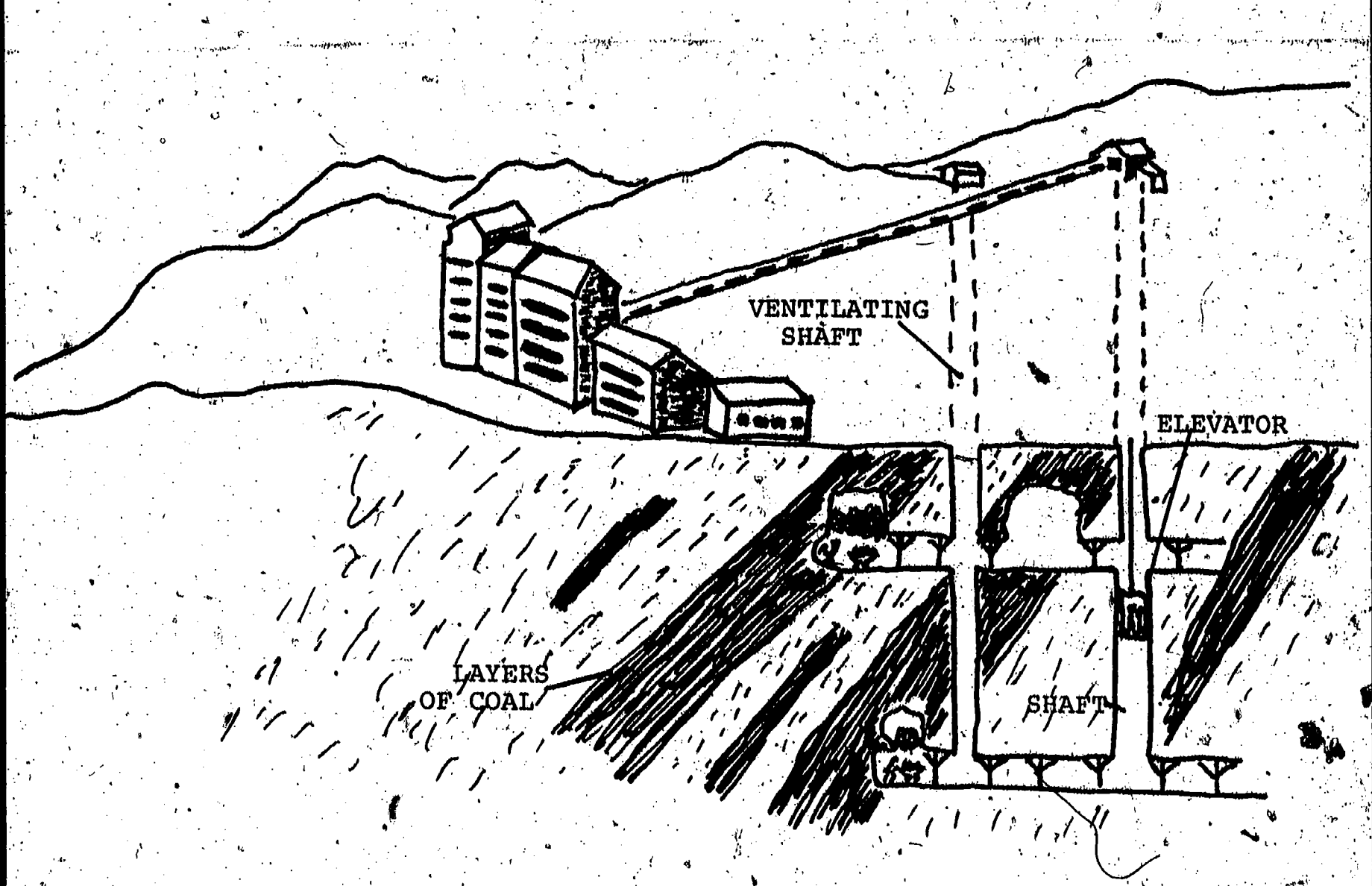
THE USEFUL PRODUCTS FROM OIL



COAL

When men dig coal from a mine they go down an elevator into a tunnel called a shaft. They go out into other shafts. A small railroad carries the coal to the main shaft. It is then raised to the top of the ground. Fresh air is pumped into the mine for the miners to breathe.

A COAL MINE

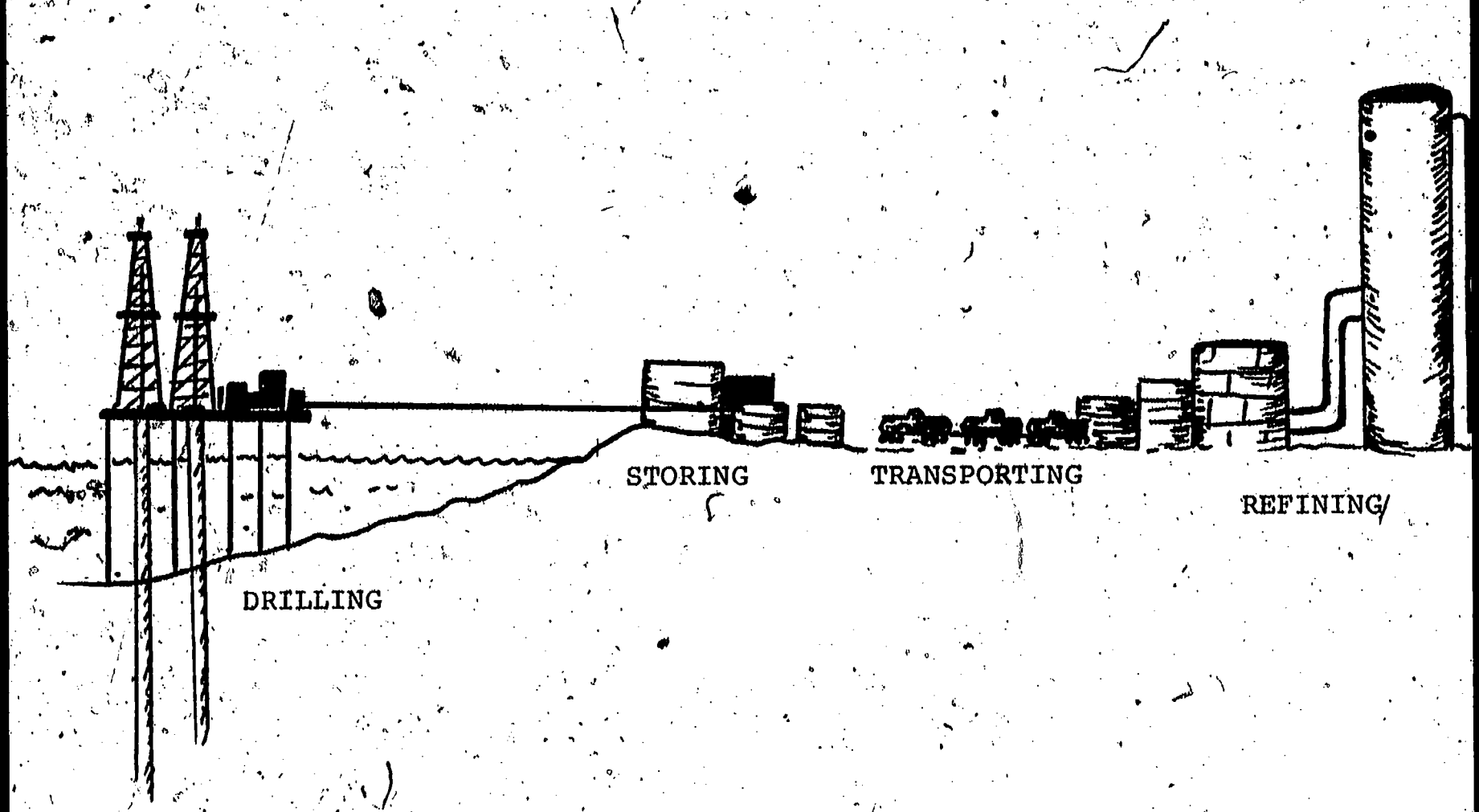


L.A.P. FOUR
JOBS AND FOSSIL FUELS
CAREER SHEET

You have been learning about F _ _ _ _ _ F _ _ _ _ _ _. We will study the different kinds of jobs relating to fossil fuels.

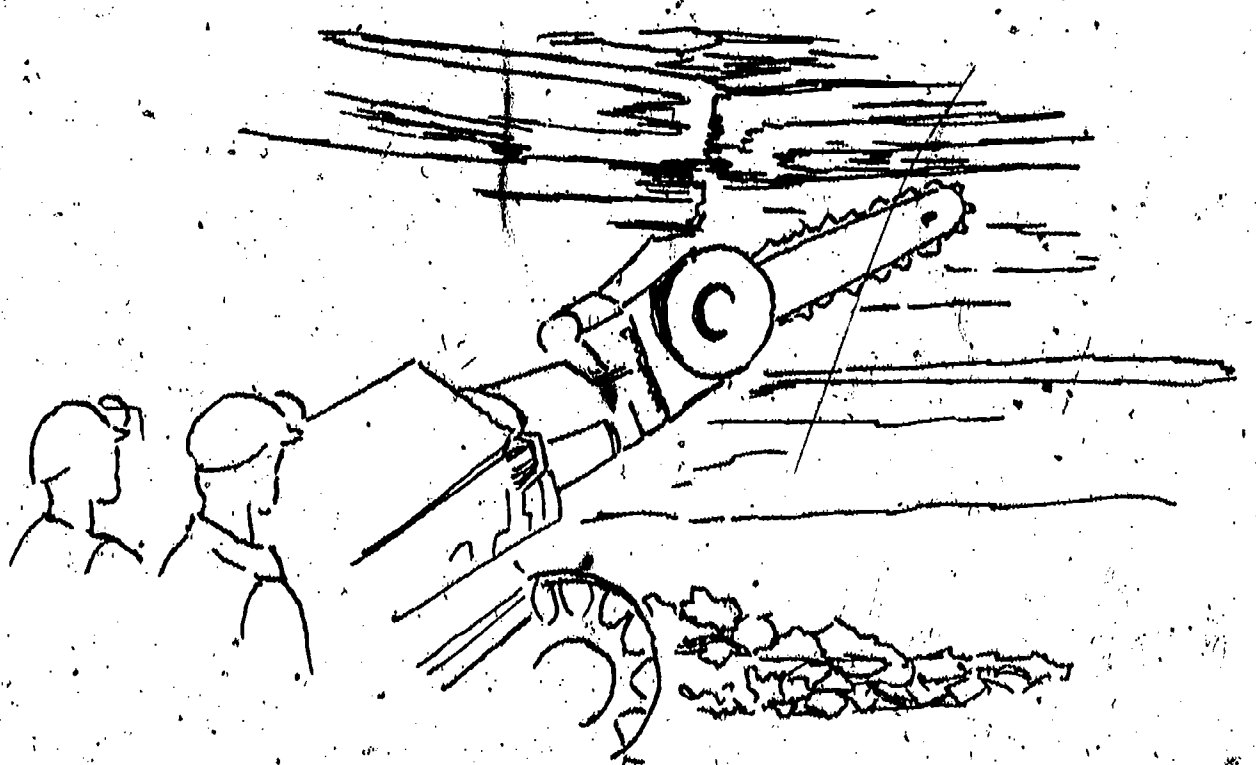
From the time men used their hands to do work, until he used machines, jobs have changed. When men began using machines that ran on fuel, jobs really grew. Can you think of some of the different fuels? They are OIL, COAL and NATURAL GAS. From OIL we get the gas to run cars. Power plants burn COAL to make electricity. People use NATURAL GAS to run stoves and heat homes. The uses of fossil fuels should give an idea of what kind of jobs exist.

Remember these fuels are mostly RAW MATERIAL. That means men have to WORK to get them. How do we get them? Men drill wells, and they dig mines. Then, men change (REFINE) the fuels into a useable form. They move (TRANSPORT) the fuels around the country. They STORE the fuels and sell them. People and companies buy and use the fuels. With this kind of work to do, what are some jobs men do?

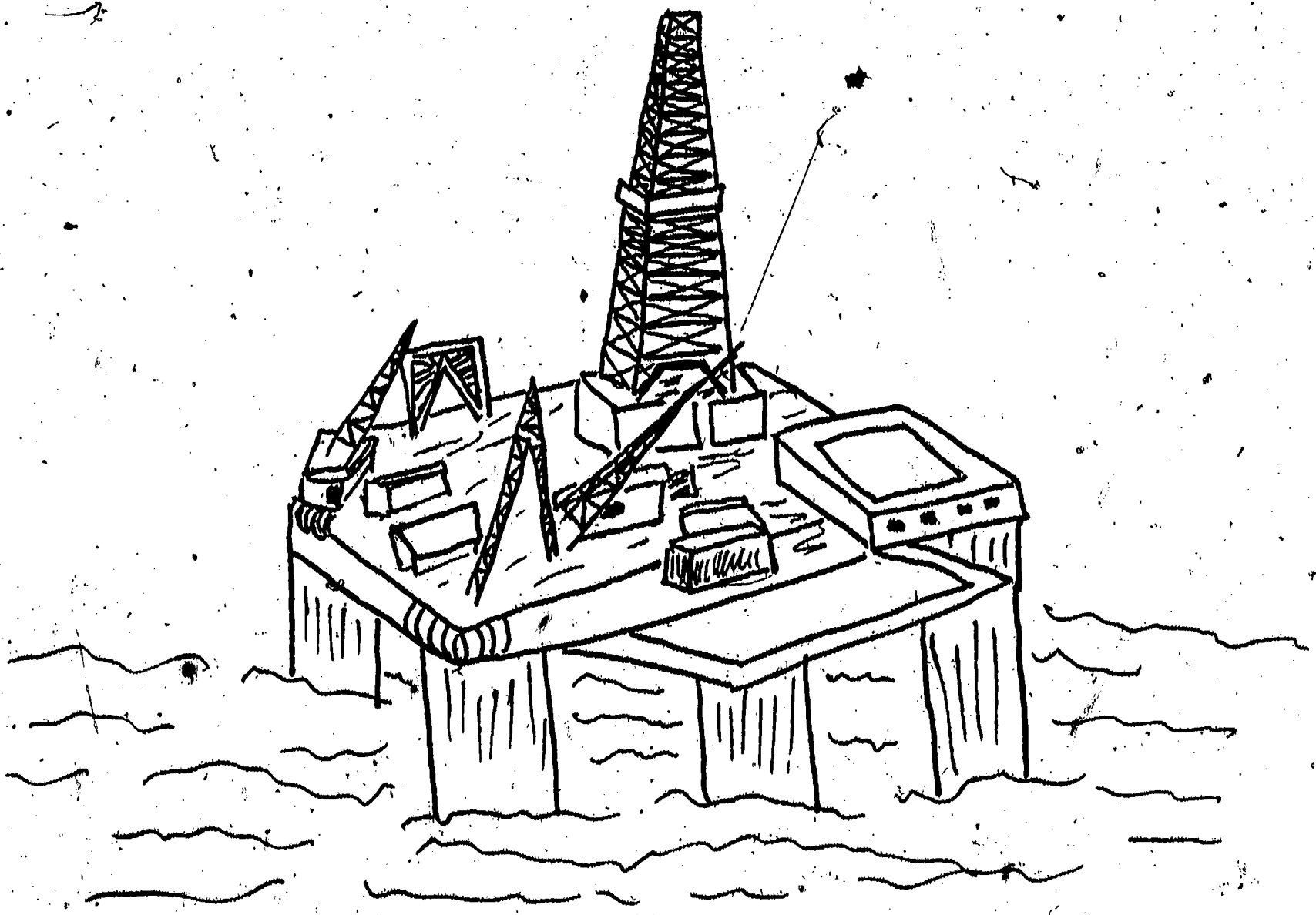


Here is a list of a few jobs and their definitions:

1. GAS STATION ATTENDENT: They work to service their customer's automobiles. They pump gas and clean windshields. Attendents also check oil, batteries, and tires. Some install needed parts to repair cars. Others drive a repair truck to help customers whose cars break down on the road.
2. SHIPPER OR SHIP CAPTAIN: Supervises the operation of the crew while having complete responsibility for the safety of passengers, cargo and vessel.
3. OIL DRILLER: Assists in drilling operations and operates machinery used in raising and lowering of drill pipe and castings.
4. AIRCRAFT MECHANIC: Aircraft mechanics work at airports repairing planes. They must see that airplanes run safely. These mechanics often specialize in working on one part of the plane, such as propellers or landing gears. They check the plane for signs of trouble and replace worn parts when necessary.
5. CONSERVATIONIST: Responsible for keeping our environment balanced and making sure we do not misuse our natural resources.
6. OIL REFINERY WORKER: He does his part in the processing of oil. Responsible for maintenance of equipment. He oversees the stocking and shipping of oil.
7. INDUSTRIAL PHYSICIST: Conducts research into two forms of energy, structure of matter, and relationships between the two. He also develops methods of applying laws and theories of matter and energy to industry.
8. PIPELINE LAYER: Installs pipe systems that carry water, steam, air, or other liquids or gases needed for sanitation, industrial production or other uses.
9. MARINE GOEPHYSICIST: Studies the physical characteristics of ocean water, such as density, temperature and ability to transmit light and sound.
10. COAL MINER: Extracts materials from the earth for use by manufacturing industries.



11. GAS METER READER: Reads meters to find out how much natural gas has been used.
12. GEOGRAPHER: They study where people are in the world and the type of land they live on. They also search for natural resources all over the globe. Geographers work for colleges, the government, and publishing companies in their job of mapping the features of the Earth.
13. MARINE ENGINEER: Designs and oversees construction of marine power plants, propulsion systems and other mechanical and electrical equipment on ships, docks and marine facilities.
14. CHEMIST: Chemists work in laboratories mixing and testing chemicals. They try to make new chemicals and watch how chemicals change when mixed. By doing this, chemists can help make old products better. Some of the products chemists help make are drugs and fuel for space travel. Their knowledge has also helped make plastic parts for automobiles and improved frozen food.
15. MARINE ARCHITECT: Designs and oversees construction and repair of marine craft and other floating structures.



ACTIVITY
JOBS AND FOSSIL FUEL

OIL	COAL	NATURAL GAS

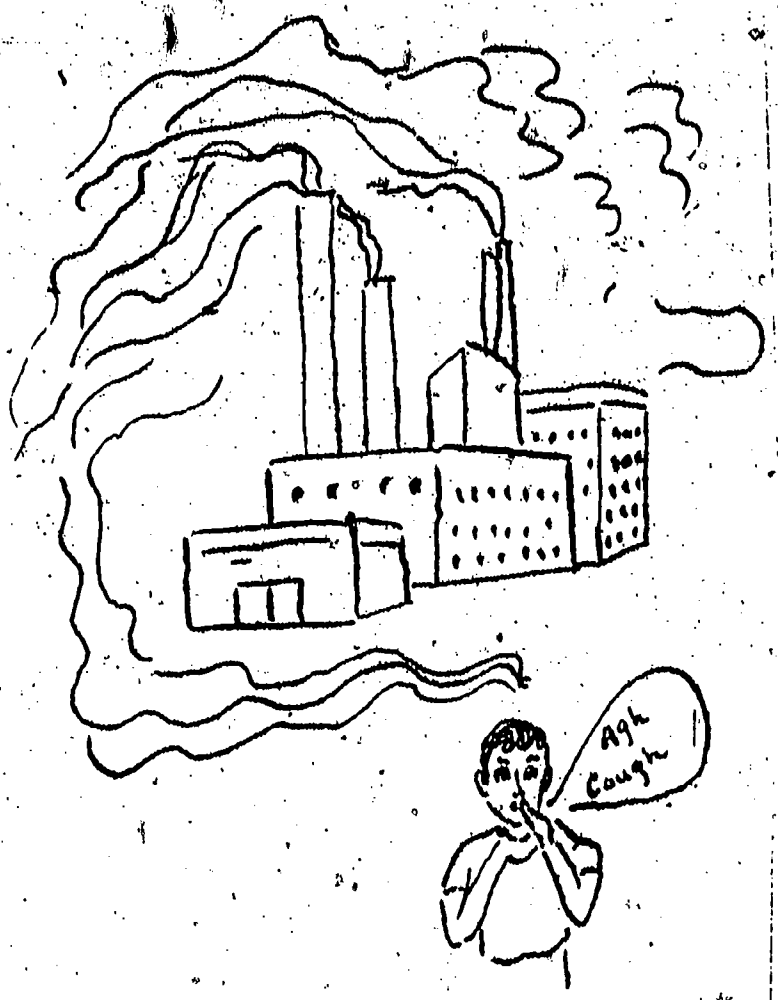
DIRECTIONS:
Which careers go with each fossil fuel listed at the top? Write the career names under the fossil fuel.

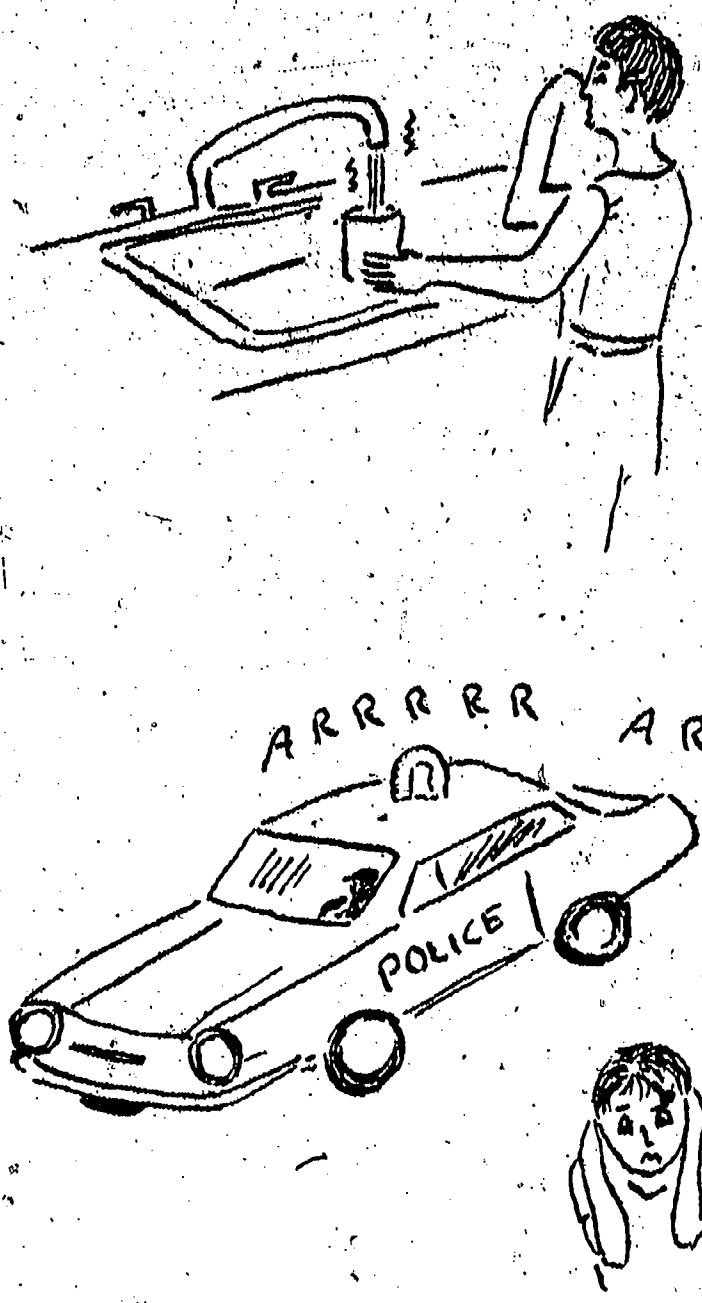
CAREER NAMES:

GAS STATION ATTENDENT
SHIPPER OR SHIP CAPTAIN
OIL (PETROLEUM DRILLER)
AIRCRAFT MECHANIC
OIL REFINERY WORKER
CONSERVATIONIST
PHYSICIST (INDUSTRIAL)
MARINE ENGINEER
PIPELINE LAYER
MARINE GEOPHYSICIST
COAL MINER
GAS METER READER
GEOGRAPHER
CHEMIST
MARINE ARCHITECT

L.A.P. FOUR
ENVIRONMENTAL IMPACT OF FOSSIL FUELS

When we talk about OUR ENVIRONMENT, it means the place we live in. We have home, school, city, state, country, and world environments. People live in all of these places. Where there are people, there are machines. Many of the machines use FOSSIL FUELS. So, where there are a lot of people, there are a lot of fuels being burned. What does this mean in relation to our environment? See if you can guess. Use the pictures below for hints.





It means the factories and cars that use the fossil fuels also POLLUTE our world. The air and water is polluted in many places, especially in big cities. Noise from all the different machines is a kind of pollution too! Now we will study each one of these problems.

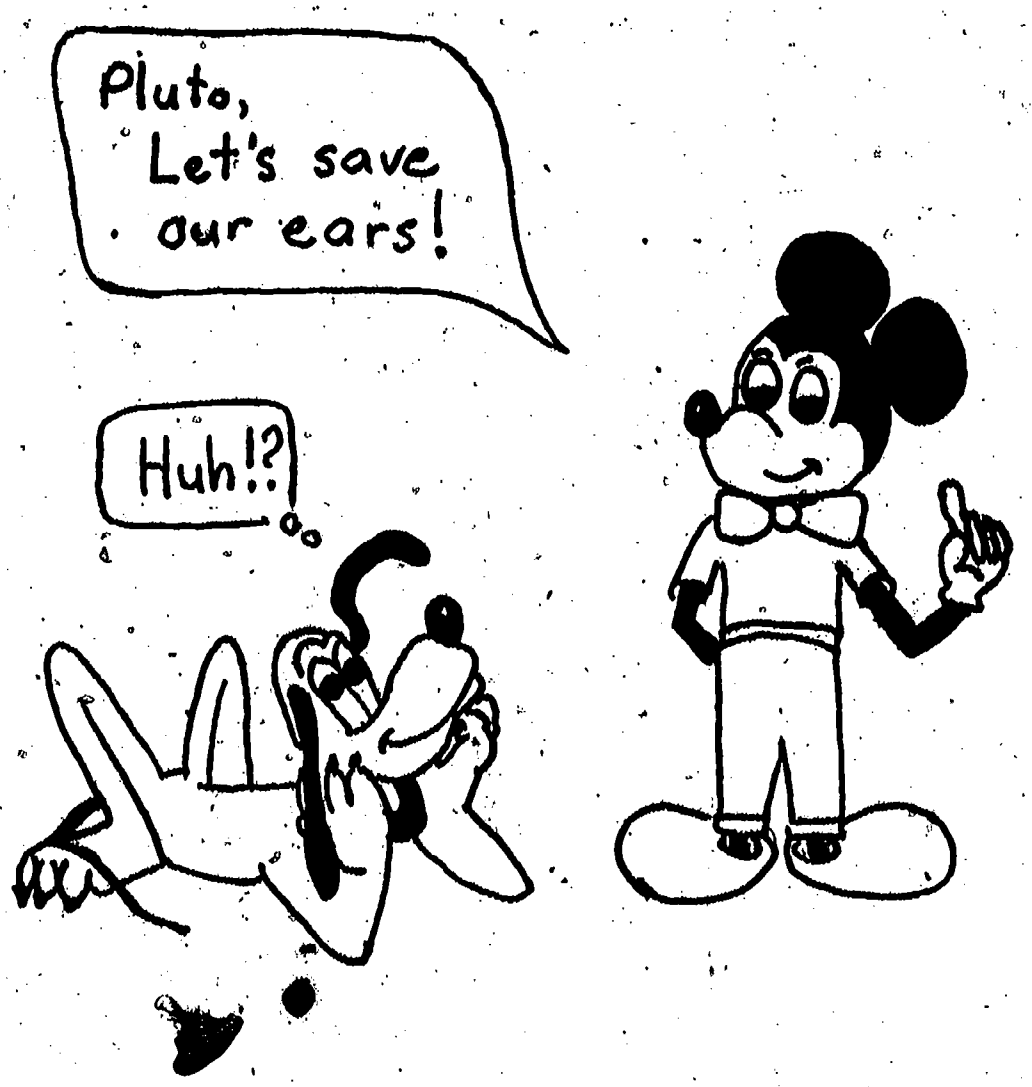
NOISE POLLUTION

Noise is unwanted sound. These sounds are unpleasant because of loudness, shrillness, suddenness, and length of time. Noise pollution is a health problem. Noise can damage your hearing. Too much or too loud a noise can make a person nervous or mad. A radio playing is sound. But if you are trying to sleep is is N _____. Worse noise problems come from airplanes, cars, lawnmowers and factories. In the home there is plenty of noise. TV, radio, air conditioners, washing machines, and record players all add to noise P _____.

Noise outside the home doubles every ten years. Noise inside the home has doubled in the past 40 years. Over 6 million factory workers in the United States will be partly or completely deafened by factory noise.

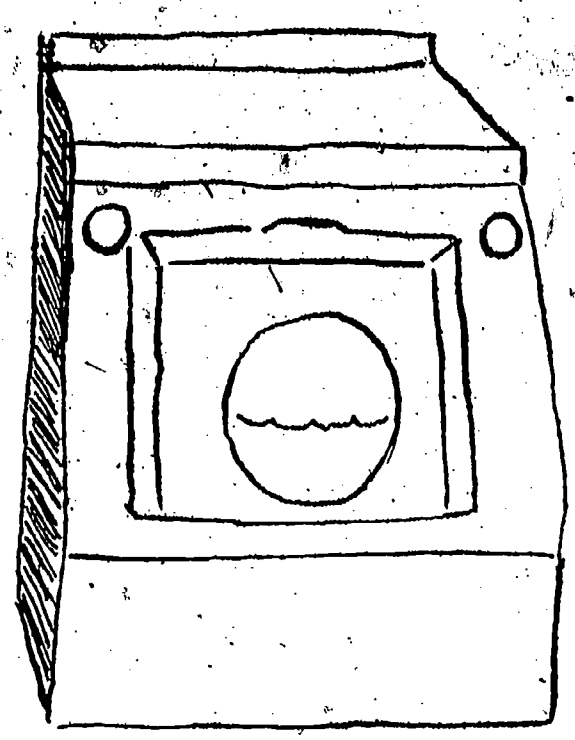
ACTIVITY

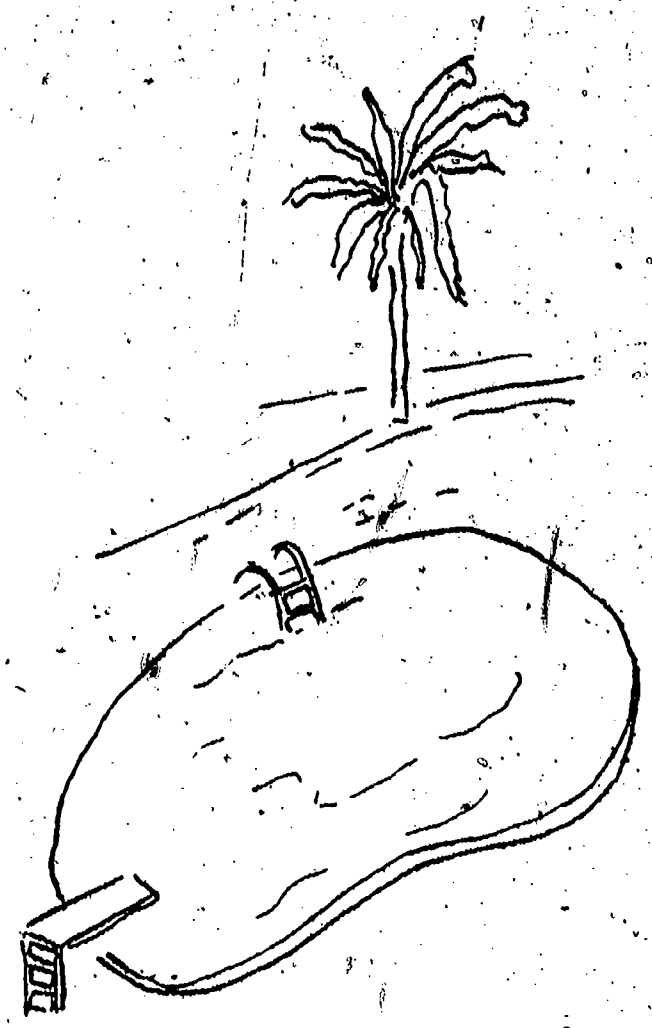
1. Where is it loudest at your school? _____
2. Where is it quietest at your school? _____
3. Which place would be easiest on your ears and nerves? _____



WATER POLLUTION

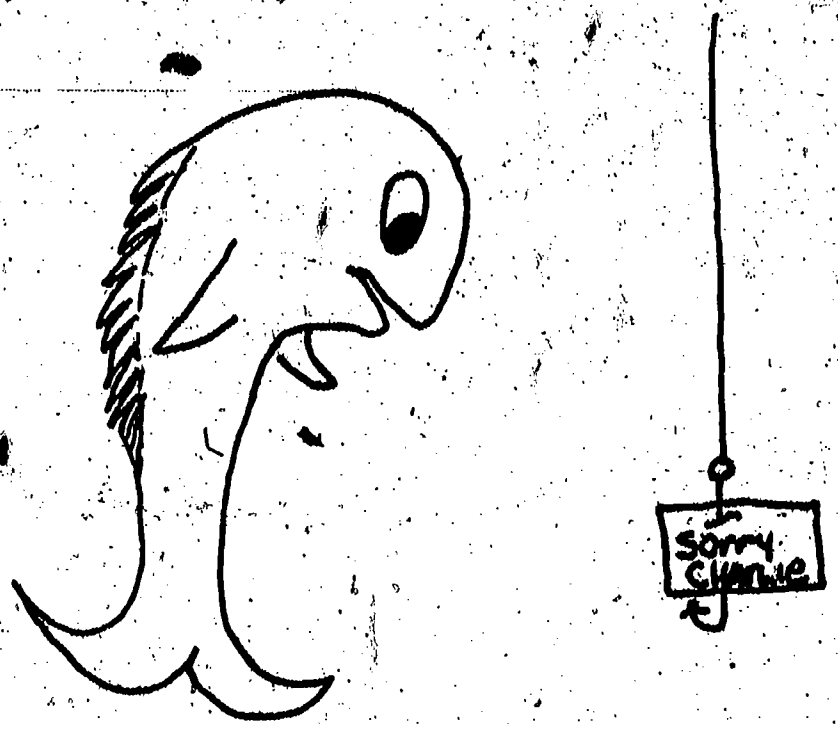
The most common thing on earth is water. We have been using water all our life. Do you know how much water the average person uses daily? In 1900 the average person used 95 gallons of water a day. He used it for drinking, washing, everything. Today, the average person uses 150 gallons of water a day. How much water does your family use in a day? How much water does your family use in a month? What has caused this change in water use since 1900?





That's right! Washing machines, swimming pools, and other items. Believe it or not - the water an average man drinks and gets from food adds up to about ONE TON of water a year. So, you can see how important water is to man.

Water is very important to F _ _ _. Not only fish need water, but all living things need water to live.

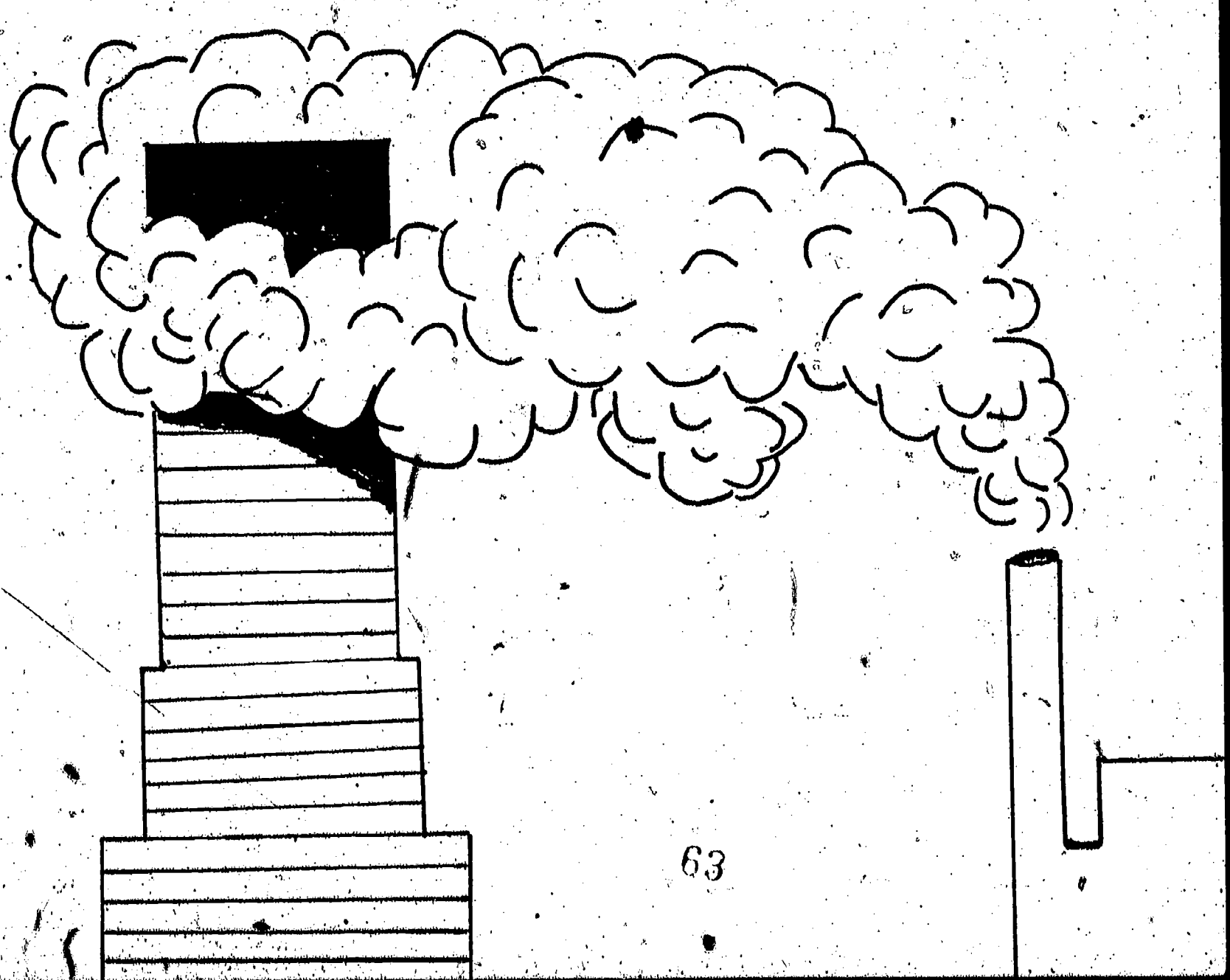


Every year many MILLIONS of fish are killed by water P_____. Water becomes polluted in different ways. SEWAGE dumped into lakes and rivers POLLUTE. INSECT SPRAY for crops drain into streams and lakes. Oil spills from ships or wells POLLUTE. Wastes from factories enter rivers and streams. Water used to cool power plants and factories are drained into rivers while it is still warm. This warm water KILLS fish and plant life in the water.

AIR POLLUTION

As you can see, man's use of energy from FOSSIL F_____ is causing problems. Still another problem is the air we BREATHE! The air is being polluted by chemicals released into it by industry, planes, and mostly CARS. Why is air pollution dangerous? First of all, living things need CLEAN air to BR_____. Polluted (dirty) air makes your lungs dirty. And dirty lungs make you sick. Also, polluted air can kill plants and animals.

How can you tell if the air is dirty? Look around, do you see smoke, or haze in the air? Take a deep breath. Did it make you cough? Now, sniff the air. Does it smell? Some polluted air you can't see or smell. AND SOME YOU CAN!



FILMSTRIP

We have been talking about the ways energy use and production affects our environment. Your teacher will be showing you a filmstrip entitled "Energy and Its Cost to Our Environment". The filmstrip first looks at the automobile, a major source of environmental pollution. Secondly, it examines the problems created by the production and use of electricity. The environmental effects of our dependence on petroleum and coal are discussed. Finally, the filmstrip looks at new techniques for obtaining fuels for energy. Watch carefully so that you can discuss what you have seen after viewing the filmstrip.

L.A.P. FOUR

HOW HAVE FOSSIL FUELS AFFECTED OUR LIVES?

VALUE SHEET

IMAGINE

Life on the Earth was greatly changed when people learned how to get energy out of fossil fuels - first coal, then oil - and use it to do work. We usually take these changes for granted, but let's imagine the following situations and think of what they would be like.

SITUATION 1.

Before the use of fossil fuels.....

A. What did people do for a living? _____

B. What did they depend on for a good life? _____

C. What kind of energy did people use? _____

SITUATION 2.

After the fossil fuels are used up.....

A. What should people use for energy? _____

B. How should life be different? _____

SITUATION 3.

A. Would you like to have lived before the use of fossil fuels? _____
Why? _____

B. Suppose the fossil fuels are used up. What would your feelings be? _____

SITUATION 4.

From the following statements, circle the one you think tells best why people should conserve energy.

A. There should be conservation of energy so that we will be able to explore outer space.
B. The more energy I save, the more money I will save, so I can buy a new trail bike.
C. If we don't conserve energy today, in the future people will not be able to have the things we have now.

SITUATION 5.

In the list below, circle the answer that you think would be best to solve our problem of too much USE of energy:

1. The government should ration electricity.
2. Raise the cost of electricity.
3. Fine or jail people who use too much energy.
4. Teach people to CONTROL their use of energy.

THE BASIC PARTS OF A CAR

In today's world a car is a basic necessity. We need a car for many reasons. A car plays such a major part in our everyday we tend to forget about just what a car is made up of and what makes it go.

Look at the boxes below. In each box an item is listed which is used in a car. After reading the items, cross out everything that is not needed for the car to work.

WHEELS	STEERING WHEEL	BRAKES
AIR CONDITIONER	PETROLEUM (OIL)	HEATER
RADIO	ENGINE	GASOLINE

From the ones you felt were the most unimportant, list why:

WHO'S FIRST?

Oak Dale had already experienced one gasoline shortage this past year. Another shortage appeared to be near at hand. The first shortage had been a nightmare. People had to wait in line for six hours or more just to get ten gallons of gas! People were late to work, they ran out of gas and they used their automobiles for the most necessary errands. During this crisis no one wanted to use a drop of this precious (gas) in a wasteful manner; not even to drive to the corner to get a coke or ice cream cone.

As a result of this gas shortage (and the trouble caused to everyone by the shortage) the City Commissioners decided to work out an emergency plan which they felt would be fair to everyone concerned. The Commissioners knew there would not be enough gasoline to fill all the cars in Oak Dale. They must decide which cars would receive gas first, how much gas to give each driver and whether or not to give some people any gas.

Please number the following people in the order in which YOU think they should receive gasoline.

_____ Tourists travelling through the city, hundreds of miles from home.

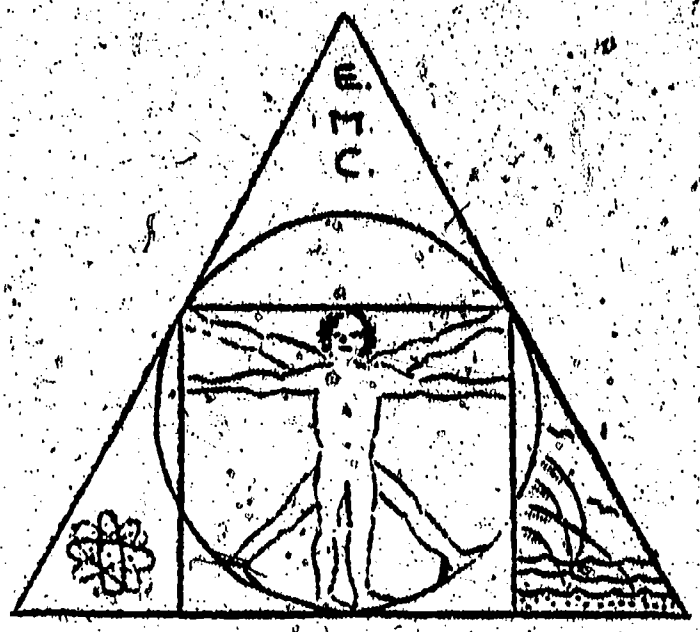
_____ Police cars, fire trucks, ambulances

_____ Doctors, nurses, pharmacists and other hospital workers

_____ Postman, garbage collectors, taxis, delivery trucks

_____ City commissioners, official business, bankers, lawyers

_____ People who live long distance from work (commuters)



This booklet is one of a set produced by the Energy Management Center of Pasco County Schools and financed by E.S.E.A. Title IV/C.

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All materials are in a preliminary pilot form and may be revised.

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