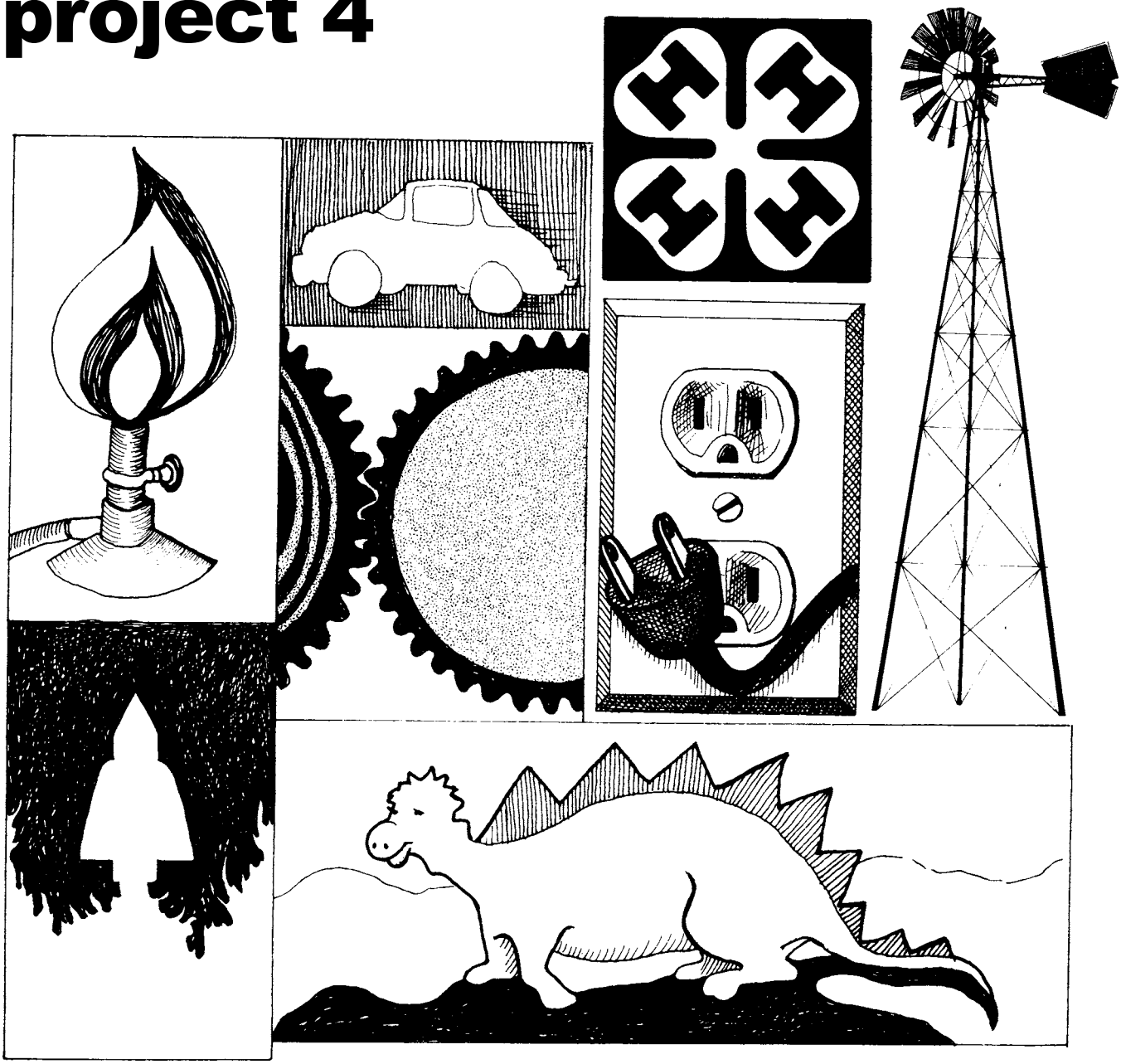
4HA-04PC

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

4H energy

project 4



4H is . . .

for all Kentucky young people between the ages of 9 through 18 and offers many activities to help you learn about things you like, or to learn more about them.
In 4-H you have fun while you learn. Ask your 4-H leader about the many projects and activities that you can do. Everything is planned just for you!

introduction

The effort you put forth at work or play takes energy. This effort can be measured in terms of "work." In this unit you will learn about work and how to measure or calculate it. You will be introduced to measurements of energy as it changes form, which is related to conversion efficiency.

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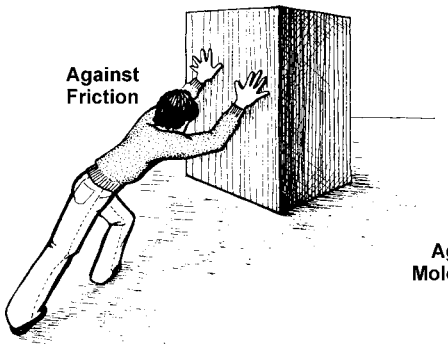
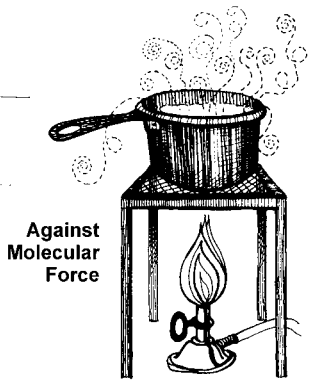
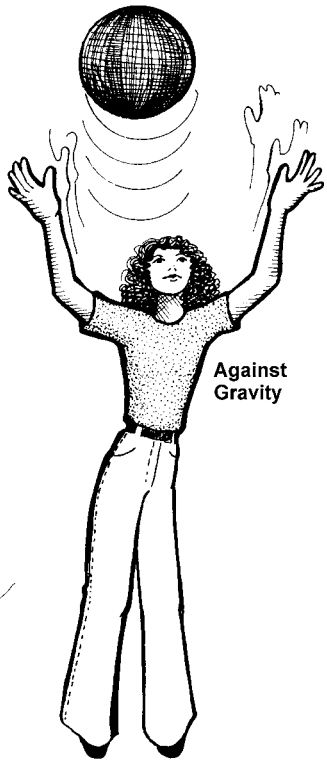
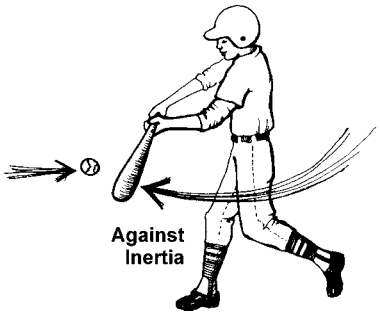
4H energy project 4









energy for work and play

learn:

Everything you do at work or play requires a force. It can be either pushing or pulling. The things we usually work against are gravity, inertia, and friction.

Gravity is the force of attraction between two masses such as the earth and objects near its surface. Inertia is the energy contained in a moving object. Friction is the resistance to movement of one object against another along a common surface.

One type of work or effort we may not be familiar with is molecular force. It takes energy to boil water. What is happening is that the molecules of water are made to vibrate very fast, and they are jarred or shaken apart with such velocity that the molecules on the surface accelerate out of the liquid into the air.

do:

Make a list of activities that you have done that fit into one of the following work or energy categories.

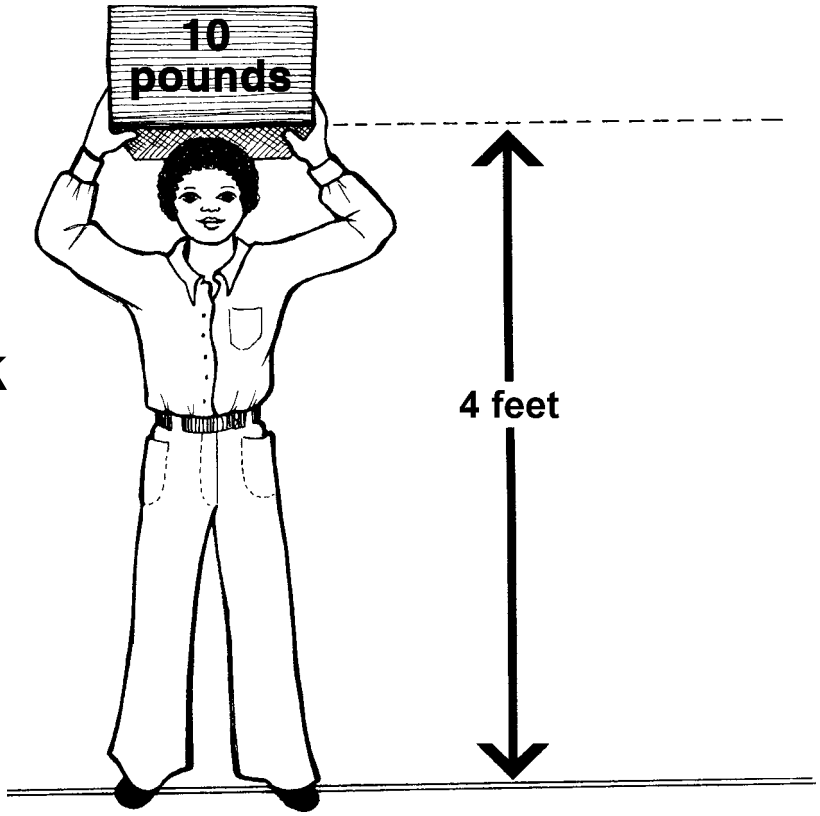
	GRAVITY	INERTIA	FRICTION
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____

discuss:

Which activities make you become “tired” the quickest? _____

Which ones are the most fun? _____

measuring work or effort



learn:

It takes effort on your part to do work. This effort can be measured. It is simply the force needed multiplied by the distance moved—in this case in an upward direction against gravity. This can be written much easier in the shorthand of arithmetic as follows:

WORK = Force x Distance

The units for the answer are foot pounds (ft-lbs) when the force is in pounds and the distance is in feet.
In the picture above, the work done in lifting the 10 pounds to a height of 4 feet is:

WORK = 10 pounds x 4 feet = 40 ft-lbs.

do:

Estimate the work it takes to climb stairs by doing the following. Measure stairs at home or school to find their vertical height in feet. Multiply this height in feet by your weight in pounds. This is the work done each time you climb the stairs. Estimate the number of times you climb all these stairs each day and multiply the number of times by the "work" each time. You then find the work you do each day climbing stairs.

My daily work climbing stairs is _____ x _____ x _____ = _____ ft-lbs daily.
(height of stairs, ft) (weight, lbs) (number of times daily)

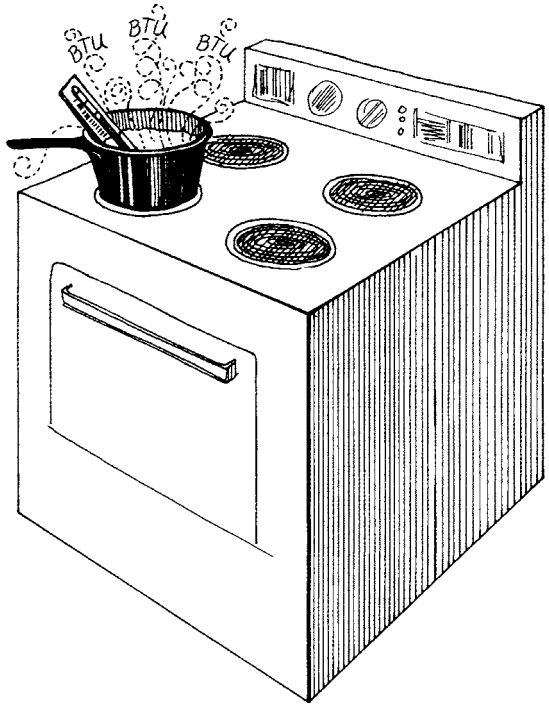
discuss:

Why is coming down the stairs not the same "work" as going up the stairs?_____

_____

Why is moving horizontally (such as walking on a level floor) different from climbing stairs? _____

_____

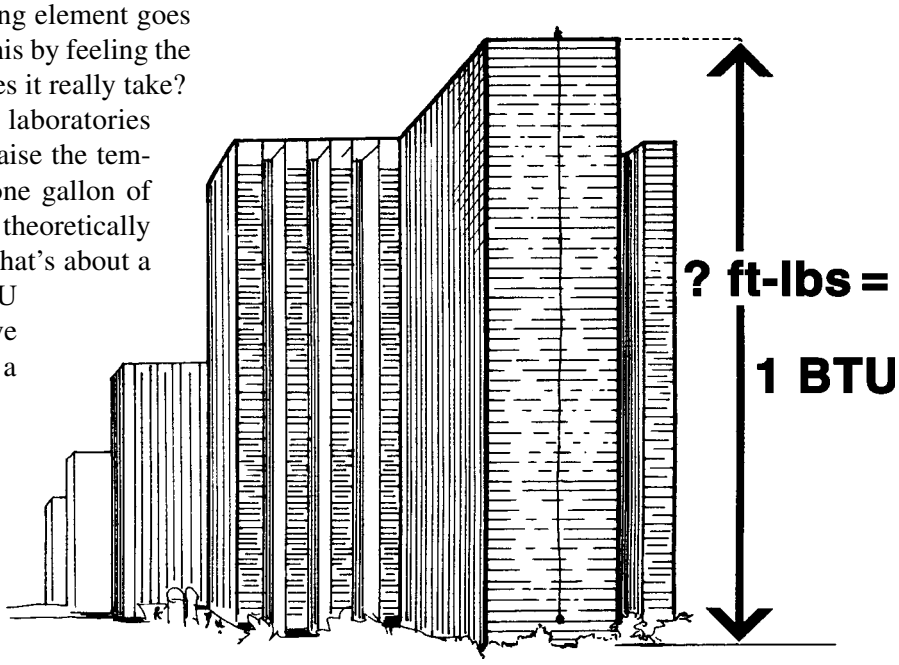


energy to make steam

learn:

When you lift something, it is easy to see or feel the effort needed to do the work. The energy needed to heat water is more difficult to see. This is molecular force. If a baking thermometer is placed in a kettle of water being heated on the range, the temperature can be seen to rise steadily as heat from the burner or heating element goes into the water. You can also experience this by feeling the warmer water. But how much energy does it really take?

Careful measurements performed in laboratories show that it takes 1 BTU of energy to raise the temperature of 1 pound of water by 1°F (one gallon of water = 8.34 pounds). This same energy theoretically could lift the pound of water 778 feet. That's about a 50-story building. In other words, 1 BTU is equal to 778 ft-lbs of energy. Observe the picture on the next page to see what a BTU is.



do:

How far up the building will this same energy lift one gallon of water? **a.** 16 ft **b.** 93 ft **c.** 6,489 ft

discuss:

What is a BTU? _____

How are BTUs measured? _____

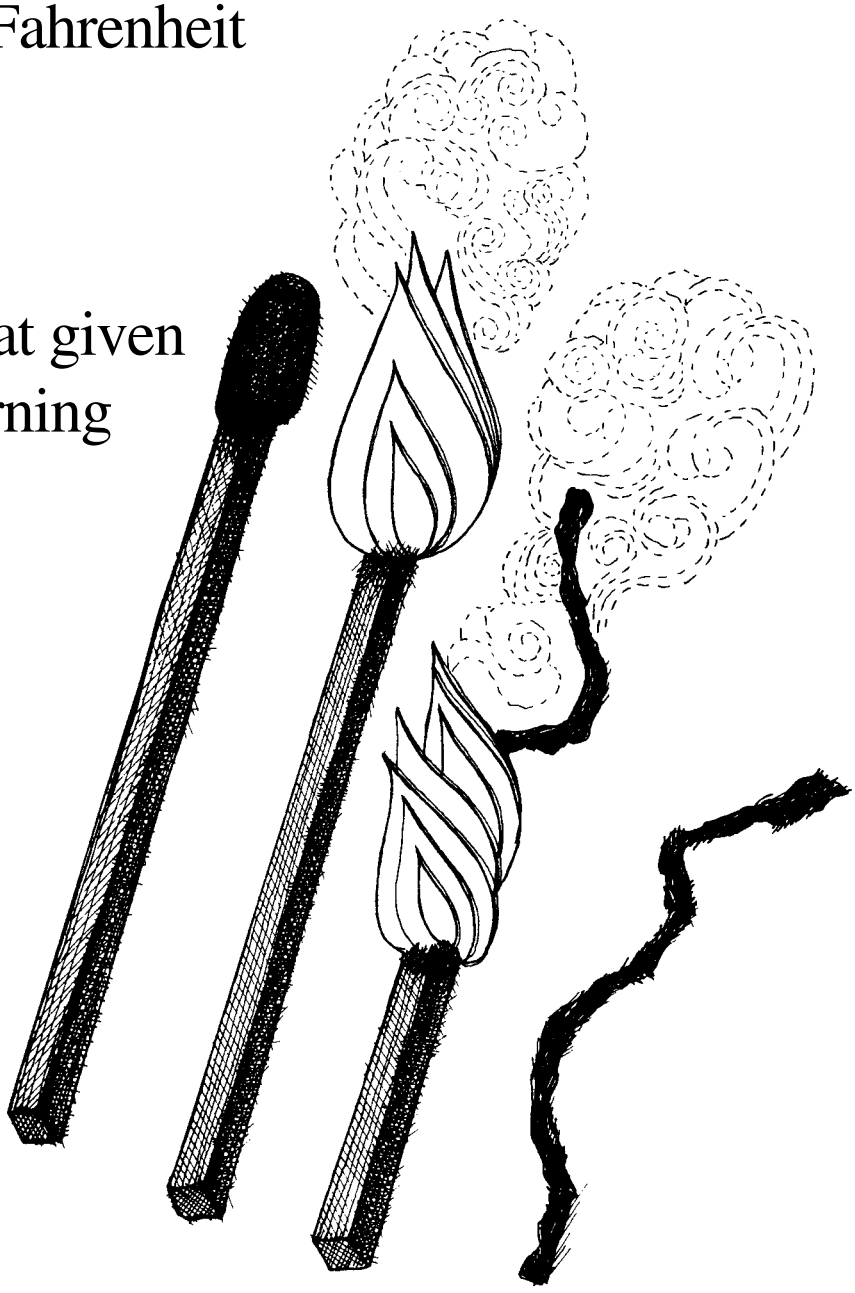
BTU

British Thermal Unit

One British Thermal Unit (BTU) is the heat needed to raise the temperature of one pound of water by one degree Fahrenheit

OR

approximately the heat given off by completely burning one wooden match.

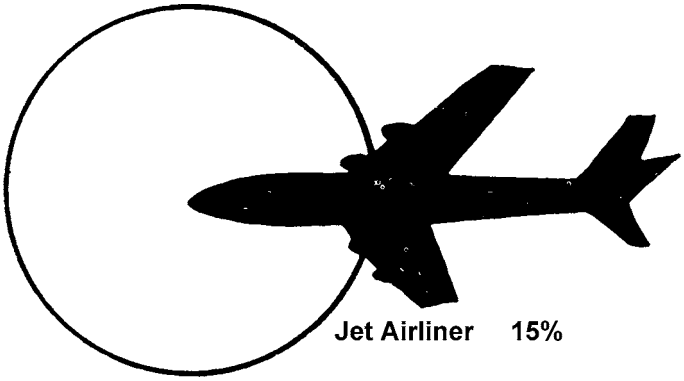


think about efficiency

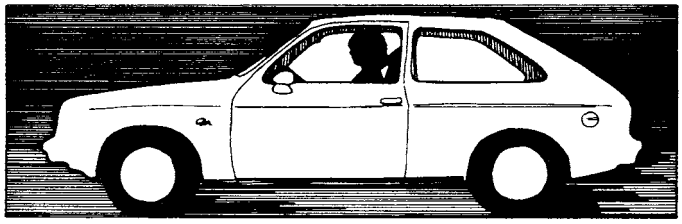
learn:

When energy is changed from one form to another, some of the original energy is always lost. Look back at the picture of the pan of water on the stove. You can feel heat from the stove and pan by just putting your hands near the pan. This shows that some heat is escaping—it is not all going into heating the water. If you hold your hand near the exhaust of an automobile, you feel heat. This is lost energy—it does not help move the car.

Efficiency is the ratio (or fraction) of useful work done to the energy that was put in. The machines in these pictures allow us to change chemical energy into mechanical energy.



Jet Airliner 15%



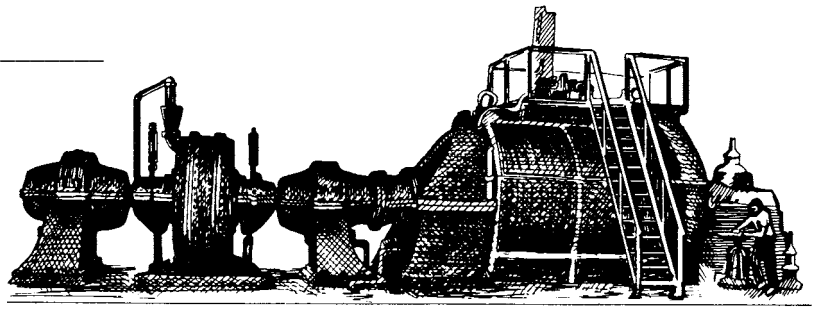
Automobile 20%

do:

Name the things your family uses that change energy from one form to another, and the forms of energy.

	Energy Form	
Task or Equipment:	**From:**	**To:**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Steam Locomotive 8%



Electric Power Plant 35%

discuss:

Which forms of energy conversion are more efficient? _____

Which forms of energy conversion are very inefficient? _____

A fuel shortage?

learn:

Have you ever experienced a fuel shortage? What causes one to happen? Look at the pictures on the next two pages. These pictures illustrate that there are many more of us than there used to be, and each of us uses more energy than we used to.

The fossil fuels that we are using now—coal, oil, and natural gas—are what we call non-renewable. That is, there is just so much of them in the earth, and no additional is being made now. These fuels are not like wood or biomass that are renewable by growing a new crop.

New sources of energy must be developed before we run completely out of the fossil fuels. We need to cut back our personal use if these fuels in order to five more time for the development of new sources. **This is the reason for conservation.**

do:

In the following blank spaces, list uses of the fossil fuels that are necessary (essential) and those that are desired (luxury).

ESSENTIAL	**LUXURY**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

discuss:

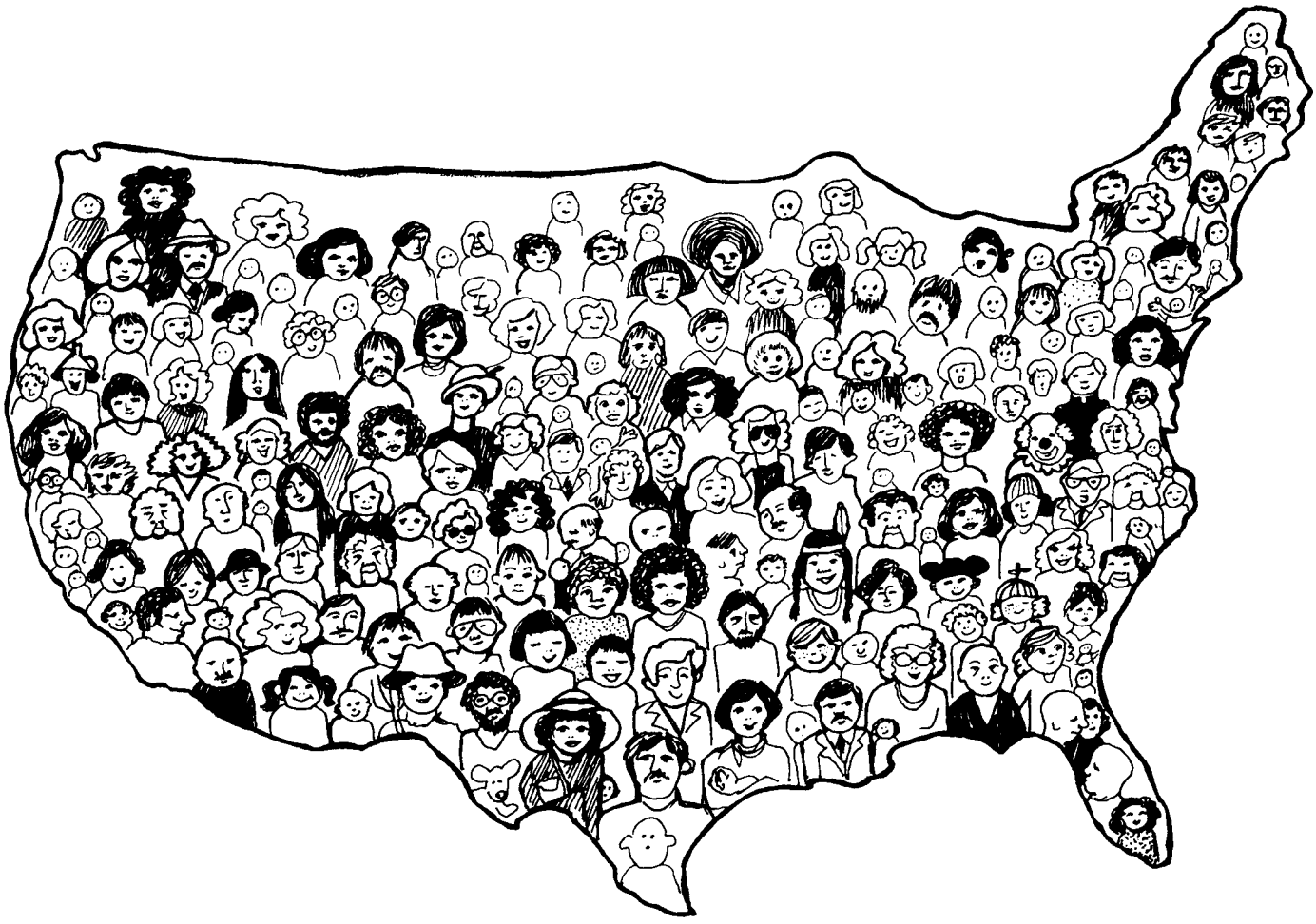
How can the "luxury" uses of fossil fuels be reduced or eliminated? _____

_____

What are some "renewable" sources of energy that could replace the "essential" uses? _____

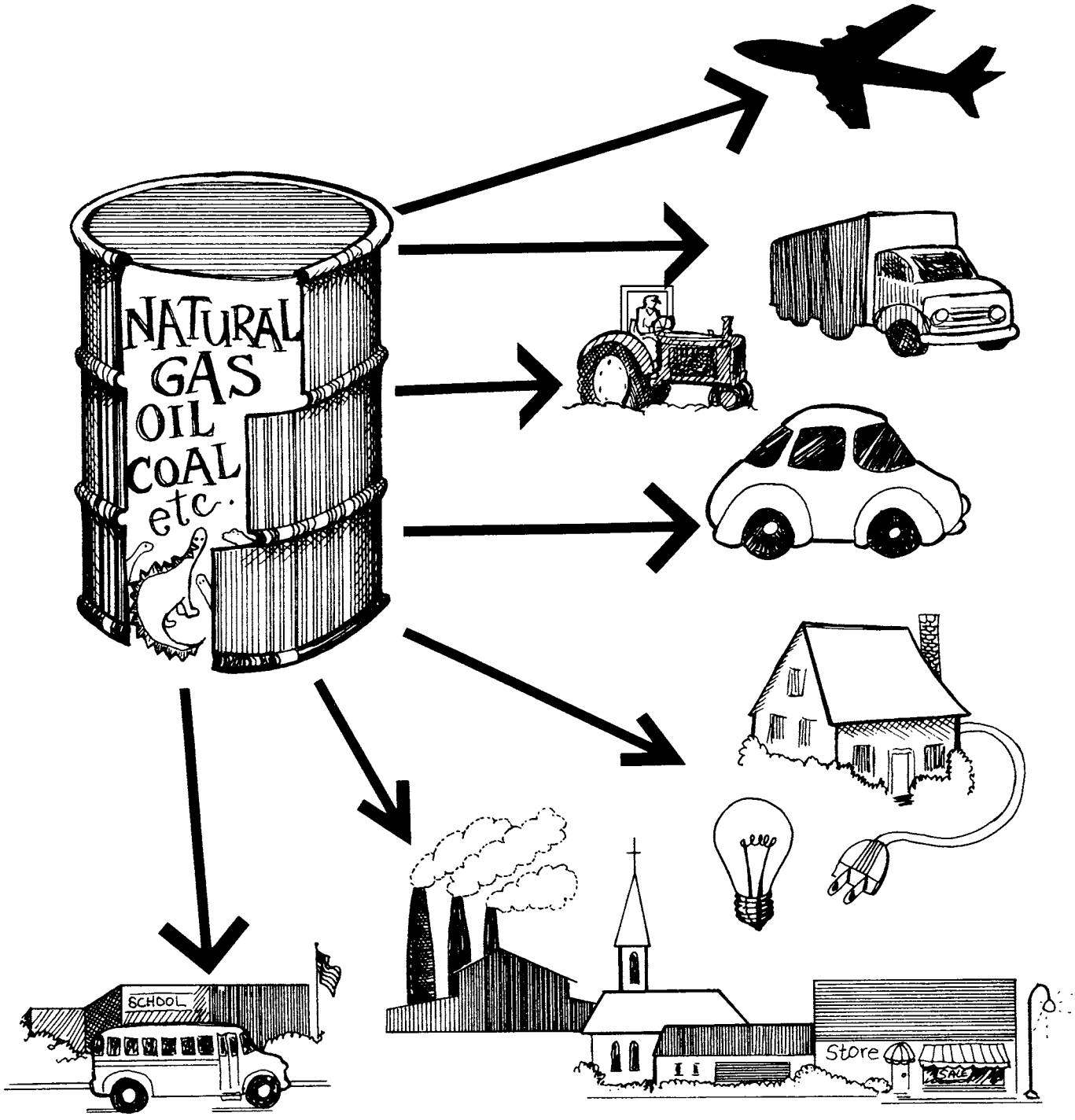
_____

Population in the U.S.A.

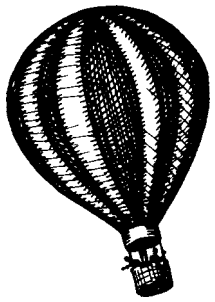


100,000,000 in 1900
150,000,000 in 1950
230,000,000 in 1977
262,000,000 in 1995
281,000,000 in 2000

Our needs and wants are drawing heavily on the energy barrel



activities to learn more about energy



1. In a group discussion, make a list of all energy sources that come to your school.
2. Have the building manager take your group on a tour of the school building and point out all things that use energy.
3. Have the building manager show where the incoming energy is measured.
4. Invite a representative of an energy supplier to meet with your group and discuss energy problems.
5. Have your group design charts to illustrate the need for conservation of energy.
6. Have your group make charts showing alternative sources of energy and why we need them.
7. Make a list of the alternative energy sources possible in your area of the country.
8. Make a list of the books in your school library that relate to energy.
9. Make a flow diagram of a source of energy from its start in the earth to its use in school.
10. Have a group discussion on ways to cut down on energy used in the school.
11. Discuss possible alternatives if an energy source to your school was cut off.

quiz

4H energy project

1. The tires of a bicycle stop you because of _____ between the tire and road when you use the brake.

2. When you throw a ball upward, you are working against _____ .

3. Chemical energy is locked up in natural gas. This can be released by burning to produce _____ .

4. When energy is changed from one form into another, there is always a _____ .

5. _____ allow us to change the stored chemical energy of fossil fuels into mechanical energy.

6. Efficiency is a measure of how well a machine can change available energy into _____ .

7. To find out how much work was done by a certain activity, you multiply _____ by _____ .

8. Three of the things we have to work against are _____ , _____ and _____ .

9. Heat energy is equivalent to mechanical energy. One BTU is equal to _____ ft-lbs.

10. A fuel shortage can be caused by two main things:

    a. _____

    b. _____

The answers are on the last page. Try to reason out all the answers before you look.

record of activities

For each of the activities you or your club decides to do, make a report following this form. These records of activities and your story will be judged if you decide to enter your project books in competition.

A. PLANNING:

1. Activity that will be done (example: Field Trip to the Utility Company)

   _____

   _____

   _____

2. Things that will be learned from this activity:

   a. _____

   b. _____

   c. _____

   d. _____

3. Steps that will be taken to do this activity:

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

B. DOING

1. Things I learned from this activity:

   a. _____

   b. _____

   c. _____

   d. _____

2. People who helped with this activity:

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

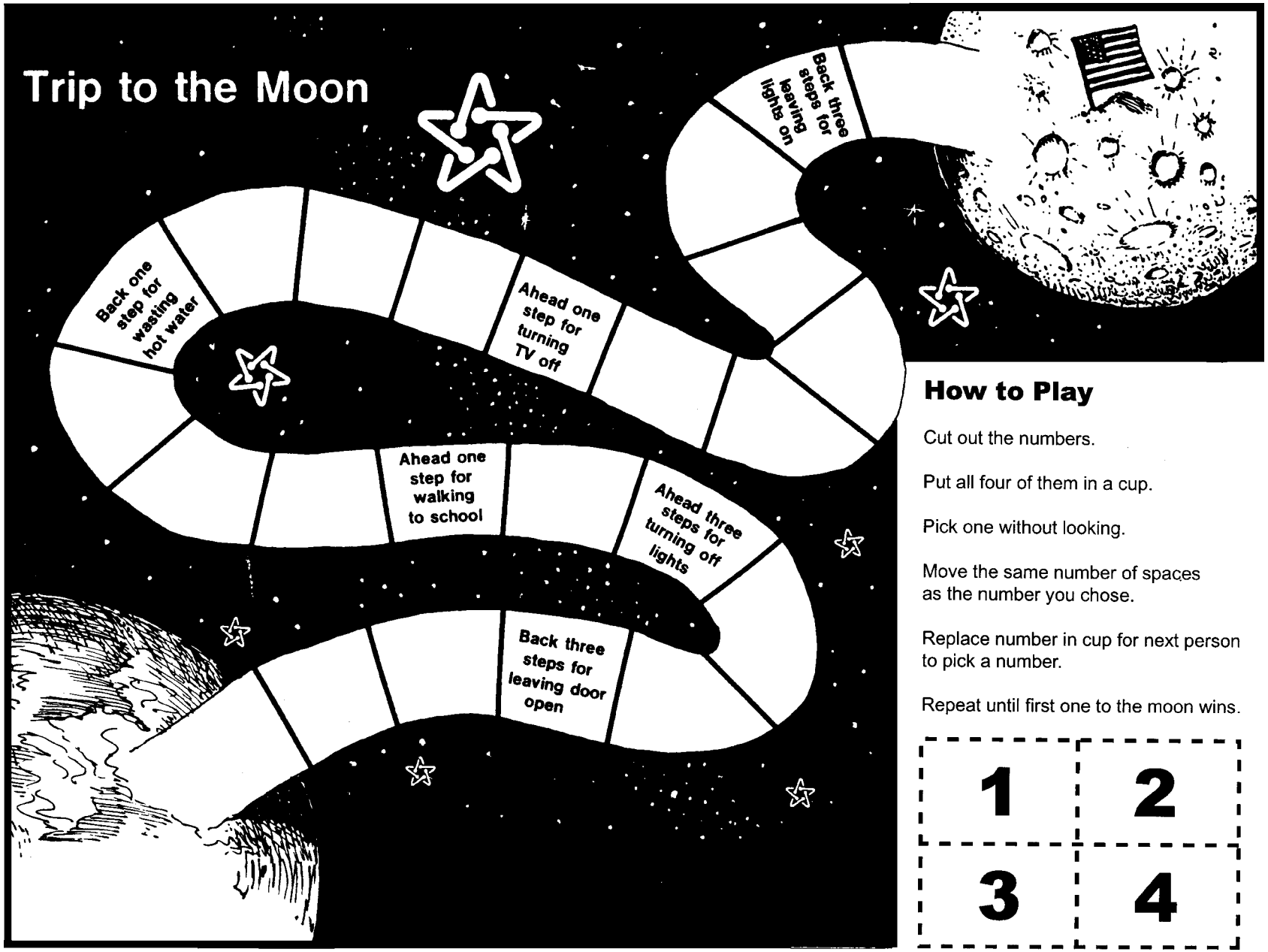
C. ATTACH PICTURES OR CLIPPINGS THAT RELATE TO THIS ACTIVITY.

my fourth unit story

On this page tell what you did in the project and some things you learned.

QUIZ ANSWERS

1. Friction
2. Gravity
3. Heat
4. Loss
5. Machines
6. Useful work
7. Force, distance
8. Gravity, friction, inertia
9. 778
10. a. Increased population
    b. Increased personal usage



How to Play

Cut out the numbers.

Put all four of them in a cup.

Pick one without looking.

Move the same number of spaces as the number you chose.

Replace number in cup for next person to pick a number.

Repeat until first one to the moon wins.

1	2
3	4