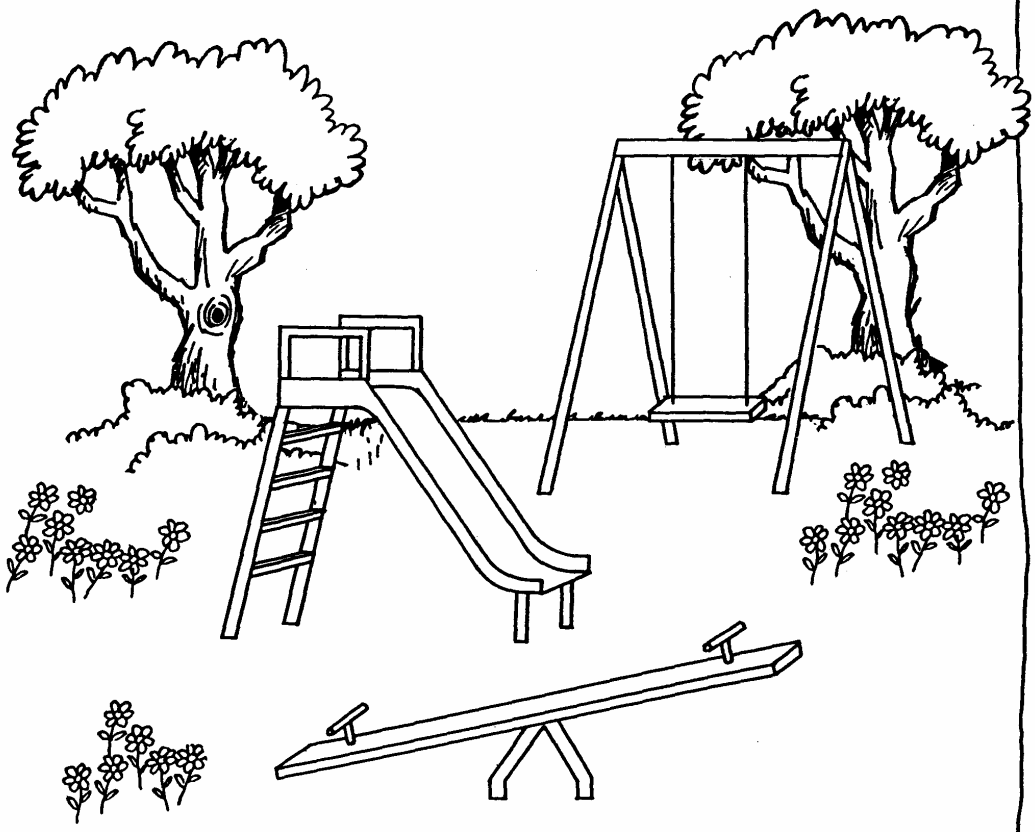
"MACHINES & TOOLS"

Look carefully at each part of the playground equipment in the drawing below.

Then, using the information you have gained, explain how each piece of equipment is like a simple machine or tool.

(Hint: Look at the shape, angle and movement of each piece of equipment.)



Made Possible By

The American Society of Mechanical Engineers

Machines and Tools

Grades

5 and 6

Knowledge

Goal: Students will be introduced to the concept of “engineering" through the use of simple machines and other familiar objects.

Activity: Bring In a simple machine or tool to display to the class (i.e., a hand tool, power tool, kitchen tool, automobile Jack. etc.) Demonstrate how the machine works. Ask your students if they can describe the operation of these common devices. In addition to the actual machines, it would be useful to show illustrations of other simple machines. Ask your students to determine what it is that various kinds of machines are able to do. After they have determined the purpose, ask them to examine each machine carefully and discuss its design. Ask the students to write an outline describing the design of the machine.

Comprehension

Goal: Students will identify objects as having been engineered."

Activity: Set up Cooperative Learning Groups with three to four students. Instruct each student group to Identify a simple machine or tool used in the classroom (i.e., scissor - two Inclined planes), school building (i.e., window shade - pulley) or playground (i.e., swing - pendulum) which have been "engineered." Use the copy master, "Machines and Tools": Slide - Inclined Plane; Seesaw - Lever; Swing - Pendulum.

Application

Goal: Students will define a problem in the classroom and “engineer" a solution.

Activity: Students should now view the educational videotape. "Engineering Is For Everyone." Stop the video a, the section where words are defined (i.e.,

aerodynamics), ask students to "brainstorm" other words which sound difficult but actually define easy concepts. Stop the tape again at the section covering food creation and paper manufacturing. Discuss with the class other things engineers have created to package or produce a product (i.e., milking machines). Students should then be encouraged to look carefully at the last section of the video in which young people display and explain their inventions. Your students can use these later as models for their own creations.

Students will then go to work in their Cooperative Learning Groups. Instruct the class to look around the room for a process which could be made easier with "engineering." After the problem has been defined, each group will describe, diagram and (as time allows) construct their invention.

An interesting class project might be to design classroom desks that are more flexible to use. The class should first determine the various arrangements of desks to facilitate different learning environments. For example, desks need to be arranged for small group work. Individual work, whole class discussions, whole class lectures, demonstrations, etc.

In this type of design activity, students can be grouped into "design teams," once the entire class has agreed on design criteria and constraints. Each design team should work with scale models to try out alternative design options. The design teams can then present their Ideas to the entire class for feedback.

Analysis

Goal: Students will identify simple and complex machines.

Activity: Display a variety of "simple machines" (level, pulley, etc.) for class discussion. Ask your students to describe how these machines work and what purpose they serve. Then arrange for a class visit to the library. Working in groups - and using books, filmstrips and videotapes - the students will investigate: (1) Why the machines were created, (2) What function they serve; (3) Ways in which they could be improved. Prior to the library visit show your students the overhead transparency, "Flight Through Time." (Contained in this kit.) Discuss the engineering improvements that took place over the years. The two most significant, continuing improvements were streamlining and creating more powerful engines. These led to aircraft capable of greater speed.

As enrichment, ask your students to look at the last statement on the timeline regarding nonstop flights. Ask them to determine the average speed (miles flown divided by hours of each flight). They can use their calculators if they choose. It is interesting to note that the difference in speed is minimal. Students can do further research of the two planes at the library.

Students should discuss the process of a machine evolving from simple to complex. An excellent reference for this activity is David Macaulay's "The Way Things Work." (Published by Houghton Mifflin Company, Boston.) This book is a visual guide to the world of machines.

Synthesis

Goal: Students will create their own engineering investigations.

Activity: Your students will return to their groups to evaluate their engineering solutions based on the new information they have gained through their research. Here, they can choose the options of "re-engineering" their original designs - or creating an entirely new design. Your role will now be to facilitate the creation of the actual "machines" by providing the student groups with advice and materials. Students in each group will designate some members as "engineers" and others as art designers who will create the illustrative diagrams documenting the development process which their group utilized. The groups will then share their diagrams and actual inventions with the class - describing the thinking and development process that went into their creations.

Evaluation

Goal: Students will organize an “Engineering Fair" to display their Inventions to others.

Activity: Help your students prepare for an Engineering Fair. Invitations should be created and sent out to other classes. Students are then to prepare their presentations for the other classes.

When the other classes arrive - show the videotape, "Engineering Is for Everyone." Your students should explain to these other classes how they have learned about engineering and the tremendous amount of products and machines that are created by engineers. Then the illustrative diagrams should be shown - with each student group explaining the thought process which led to the engineering of their Invention.

As an added enrichment project for this program we have Included Student Copy master #3 "Create an Engineering Alphabet." Working In their Cooperative Learning Groups ask students to create their own Engineering Alphabets using the copy master as a guide. Keep in mind that almost everything that is not animal, vegetable or mineral has been "engineered." When their new "alphabets" have been completed, each group can: (1) Illustrate five of the new alphabet words; (2) create a word search using their new engineering words for the class to complete; (3) use their dictionaries to complete definitions of these new words.

ENGINEERING IS FOR EVERYONE

"CREATE AN ENGINEERING ALPHABET"

Below you will see the alphabet. Next to each letter of the alphabet on these two pages is the name and picture of something which has been "engineered." Review your definition of "engineered." Color the letters in the alphabet.

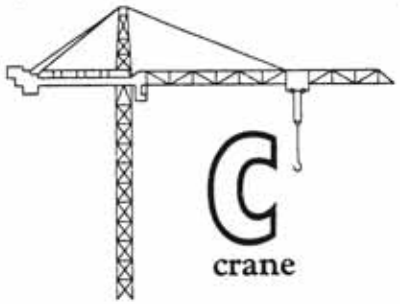
On a separate piece of paper, make your own "engineering" alphabet. Be creative – make the letters unusual-looking. Name something that has been "engineered" for each letter in your alphabet. Then — select five of these things and draw a picture of them. Look around your classroom or your school for ideas to help you.

A

automobile

B

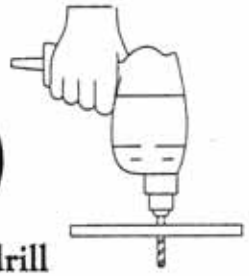
boiler



C

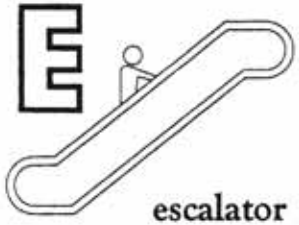
crane

D



drill

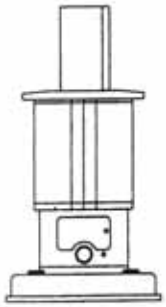
E

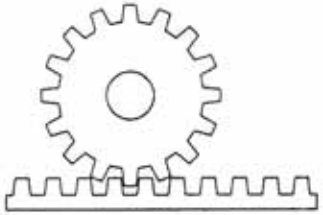


escalator

F

furnace

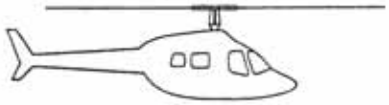




G

gears

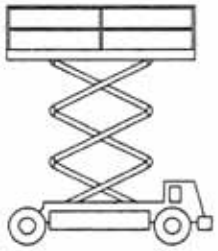
H



helicopter

I

instrumentation



J

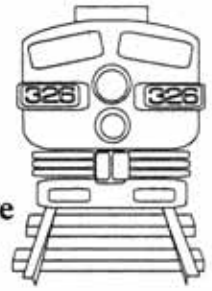
jack

K

knife

L

locomotive



M

motor

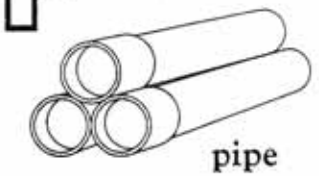
N

nuts & bolts

O

offshore drilling rig

P



pipe

Q

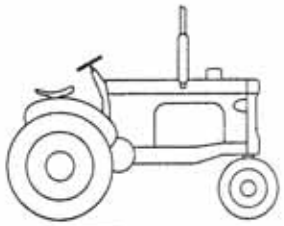
quality control

R

robot

S

scale



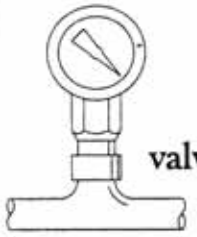
T

tractor

U

umbrella

V

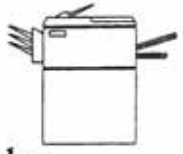


valve

W

windmill

X



xerography

Y

yacht

Z

zipper

"CREATE AN ENGINEERING ALPHABET"

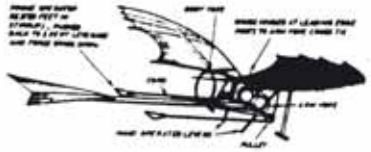
Made Possible By The American Society of Mechanical Engineers

"FLIGHT THROUGH TIME"

Two Frenchmen make first flights in hot air balloons.

1500

Leonardo da Vinci creates drawings of flying machines.



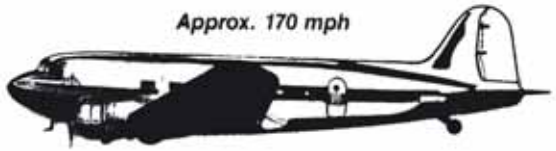
1783

1903

Orville and Wilbur Wright launch the first engine-powered, heavier-than-air flights near Kitty Hawk, North Carolina.

Approx. 15 mph

1936



Approx. 170 mph

The DC-3, one of the world's most successful transports, makes it's first flight. Engineering improvements included twin engines, streamlining and automatic pilots.

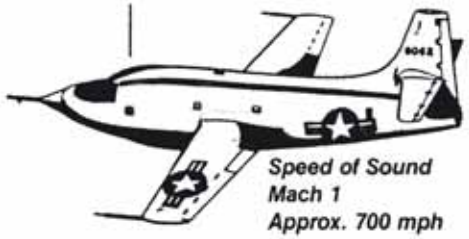
1942

Bell Aircraft Company builds the first jet plane in the United States. The jets enable planes to fly faster and higher.

300 mph to 400 mph

1947

Charles Yeager pilots the first supersonic flight in a Bell X-1 rocket plane.



Speed of Sound
Mach 1
Approx. 700 mph

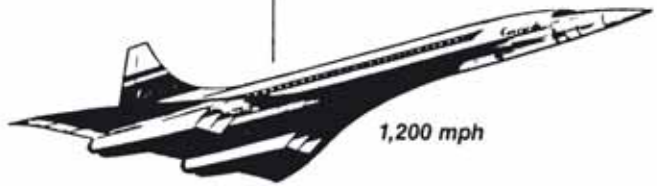
1960

The Boeing 707 jet plane begins transport service between U.S. and Europe.

Approx. 400 mph

First practical vertical take-off and landing aircraft is developed.

1976



1,200 mph

The Concorde, a supersonic transport (SST) built by Britain and France, begins passenger service.

1981

The world's first stealth warplane, the F117A, takes to the air for the first time.

1986

Dick Ruttan and Jean Yeager fly nonstop around the world (26,678 miles) in about 9 days. In 1927, Charles Lindberg flew 3,610 miles nonstop in about 34 hours.

The American Society of Mechanical Engineers