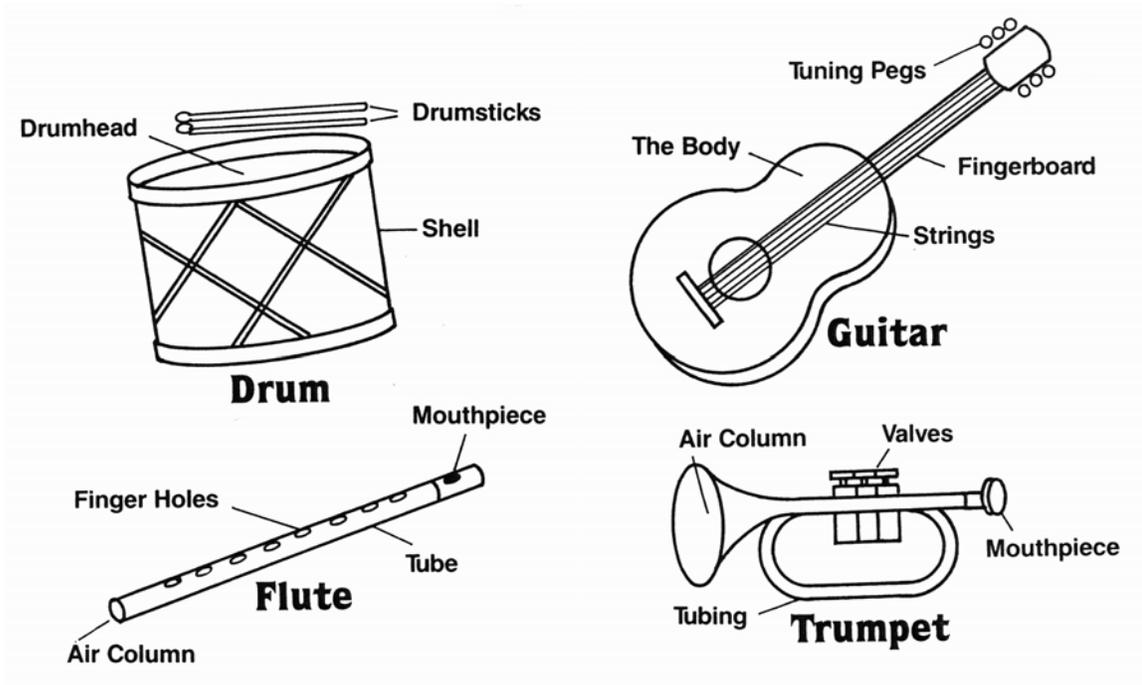


Sound and Music



Look at the drawings above. Read the names of the parts of each instrument. Answer the following questions.

1. Which part creates the sound for each of these instruments?

2. What part of each instrument amplifies the sound?

Drum _____

Drum _____

Guitar _____

Flute _____

Guitar _____

Trumpet _____

Flute _____

Trumpet _____

"SOUND& MUSIC" Grades 3&4

1. Knowledge

Goal: Students will become familiar with the word, "engineering" and understand the concept of engineering as it relates to familiar objects.

Activity: Display a simple drum to the class. Ask students, "How do you think this works?" "What causes it to make sound?" "What do you have to do to it in order to have the sound heard?" Write down your students' answers to these questions. Then display other types of musical instruments - such as a recorder or a guitar. Explain how the sound from each of these instruments is created and amplified by a resonator. Ask your students to try to think of a word which would best describe the process of making these instruments. After class discussions about this, tell the students that the word "engineering" indicates the creation of various objects. Using the "Sound & Music" Student Activity Copy master in this kit, discuss with your class the fact that all the instruments pictured on this worksheet have been designed (engineered) to create different types of sound. The class should then discuss the differences and similarities in these designs.

2. Comprehension

Goal: Students will learn that all sounds are created by objects that vibrate at different frequencies - which the human ear recognizes as different "pitches" of sound.

Activity: Set up Student Groups of three to four students - and provide each group with a meter stick or yardstick. Ask each student group to carry out investigations to answer the question, "What sounds are produced when you vibrate the stick at different lengths? For example, ask the class to compare the sound produced by vibrating a 15 cm. (6 inch) length to one that is 30 cm. long. Help the students to observe that the greater the length of the vibrating stick the lower the frequency. The differences in frequencies are perceived as sound of different pitches.

Follow-up this activity by providing each Student Group with some type of string instrument (i.e., guitar, violin, cello) or, bring one or two instruments into class and allow each group the opportunity to study them. Ask each group to come up with an explanation of how different musical notes of varying pitches are produced by the vibrating strings. Another interesting question for students to explore: "What properties of the strings affect the frequency of the vibration?"

3. Application

Goal: Students will create their own drums or other percussion instruments. They will understand the key engineering concept that "design should relate to function."

Activity: Again, display the drum to the class. Allow students to examine its construction. Then ask them to list the materials they would use to make their own drums. Suggest that they can use alternative materials to those used for the drum they see (i.e., plastics, metal cans, glass container, cardboard boxes). Working in Cooperative Learning Groups, students will select and create their own drums or other percussion instruments. Your role will be to serve as a facilitator - providing materials and suggestions as needed. After each Student Group has created a functional instrument, they are to display and play them for the other members of the class.

4. Analysis

Goal: Students will explain how various parts of musical instruments are integrated to create desired sounds.

Activity: Working in Cooperative Learning Groups, students are to brainstorm similarities among the percussion, string and wind instruments that they have created or used in the previous activities. Guide your students as they discover which parts of the instrument determine the different pitches of sound. Ask your class: "What does the

player have to do to produce sounds of different pitches?" Lead your students to discover that an instrument must have the ability to amplify as well as create sound. The resonator is responsible for amplification. Define pitch (perception of sound at different frequencies, resonator (place where sound waves build up, and amplification (to increase the volume of sound) for your students. Provide an example of differences in resonators by producing a sound on two different instruments. Another example you can use is to tighten and loosen the strings on a guitar to produce sounds of different pitch. Discuss the reason for the differences.

5. Synthesis

Goal: Students will create their own instruments.

Activity: Students should now view the videotape, "Engineering Is for Everyone." Stop the video at the section where words are defined (i.e., aerodynamics), and ask your students to "brainstorm" other words which might seem difficult - but actually define easy concepts. Stop the video again at the section which discusses food creation and paper manufacturing. Lead class discussion about other things engineers have created to package or produce a useful product (i.e., the milking machines referred to in the video). Students should be encouraged to look carefully at the last section of the tape in which young people display and explain their inventions. Your class can use these examples as models for their own creations.

Project the Student Overhead Transparency depicting the evolution of an idea, in this case - the airplane. 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.

Ask your students to outline the way in which an idea begins and then evolves. Working in their Cooperative Learning Groups, students will examine the instruments they have created - focusing on

the physical creation of the instruments. One or two members should be selected by each group to illustrate the "manufacturing" process by diagram, computer graphics, drawings, video tapes or charts. At the completion of the project, the groups will display their creations to the class.

6. Evaluation

Goal: Students will use their instruments and modify them according to the sounds they make.

Activity: The teacher will provide suggestions of some simple, well-known pieces of music (i.e., "Old McDonald Had A Farm"). Students will add their suggestions or other songs. Each group will choose a musical piece to rehearse with the rest of the class. After adequate rehearsal time, the class will send invitations to other classes in the building - inviting them to a "special" concert. When the classes arrive, the videotape, "Engineering Is For Everyone" should be shown. Students will explain to the other classes the process by which they have learned about engineering - and talk about the vast amount of products, machines, etc., which are created by engineers.

Your students will perform their music for the "visitors." Each group will then display and explain their thought processes which led to the creation of their instrument. Students should ask the visiting classes to think of some ways in which their instruments could be further and improved. Try to draw the visiting students into discussion.

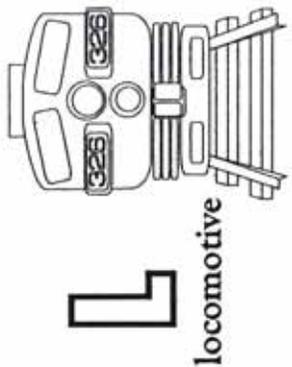
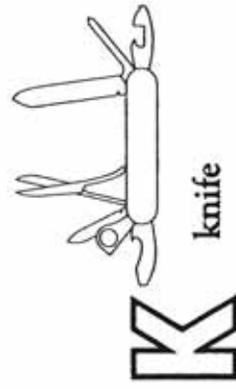
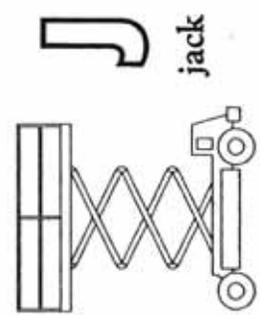
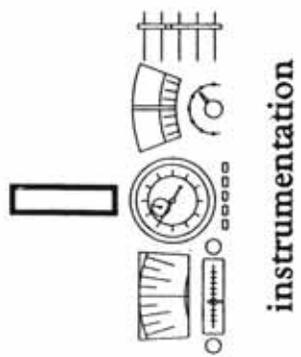
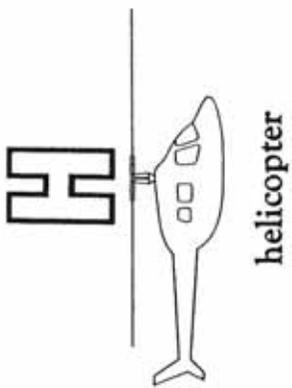
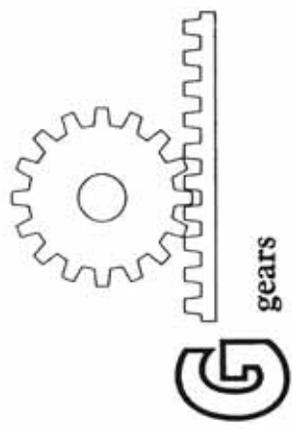
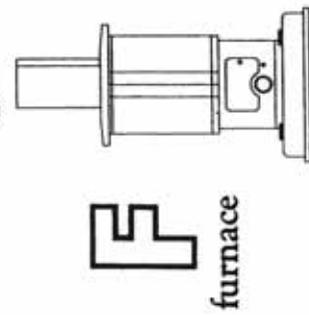
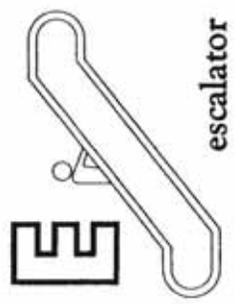
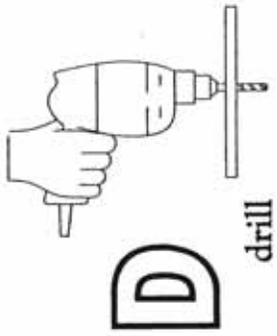
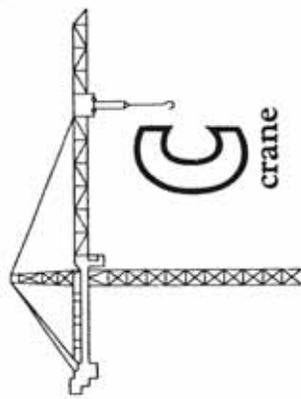
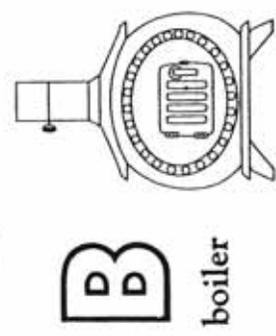
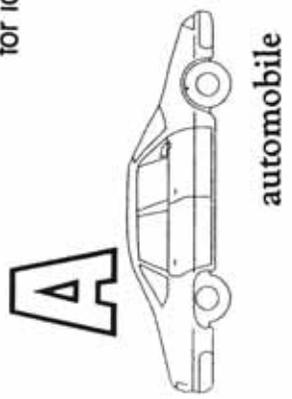
As an added enrichment project, we have included Student Copy master Activity #3 "Create An Engineering Alphabet." Working in their Cooperative Learning Groups, ask students to create their own Engineering Alphabets using the copy master as a guide. Keep in mind that almost everything that is not animal, vegetable or mineral has been engineered. When the new "alphabet" is completed, ask each group to: (1) color the alphabet letters; (2) illustrate 5 of the new engineering words; (3) select 5 of these words and use their dictionaries to complete their definitions.

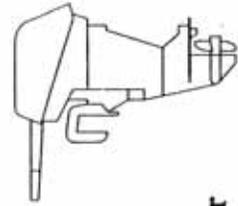
ENGINEERING IS FOR EVERYONE

“CREATE AN ENGINEERING ALPHABET”

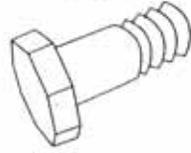
Below you will see the alphabet. Next to each letter of the alphabet on these two pages is the name and picture of something which has been “engineered.” Review your definition of “engineered.” Color the letters in the alphabet.

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.

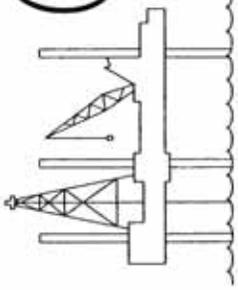




M
motor



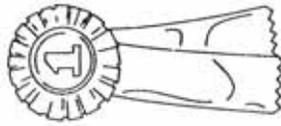
N
nuts & bolts



O
offshore drilling rig



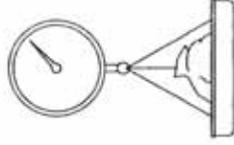
P
pipe



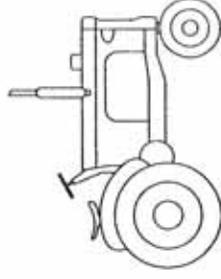
Q
quality control



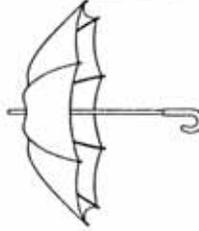
R
robot



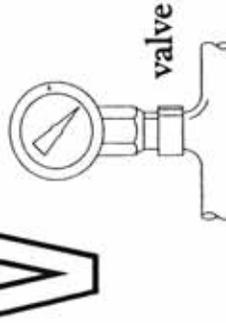
S
scale



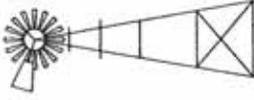
T
tractor



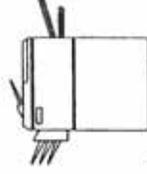
U
umbrella



V



W
windmill



X
xerography



Y

yacht



Z
zipper

“CREATE AN
ENGINEERING ALPHABET”



Made Possible By
The American Society of
Mechanical Engineers