

Imagine, Design, Build

“Engineers Make the Best Better.”



What is an engineer?

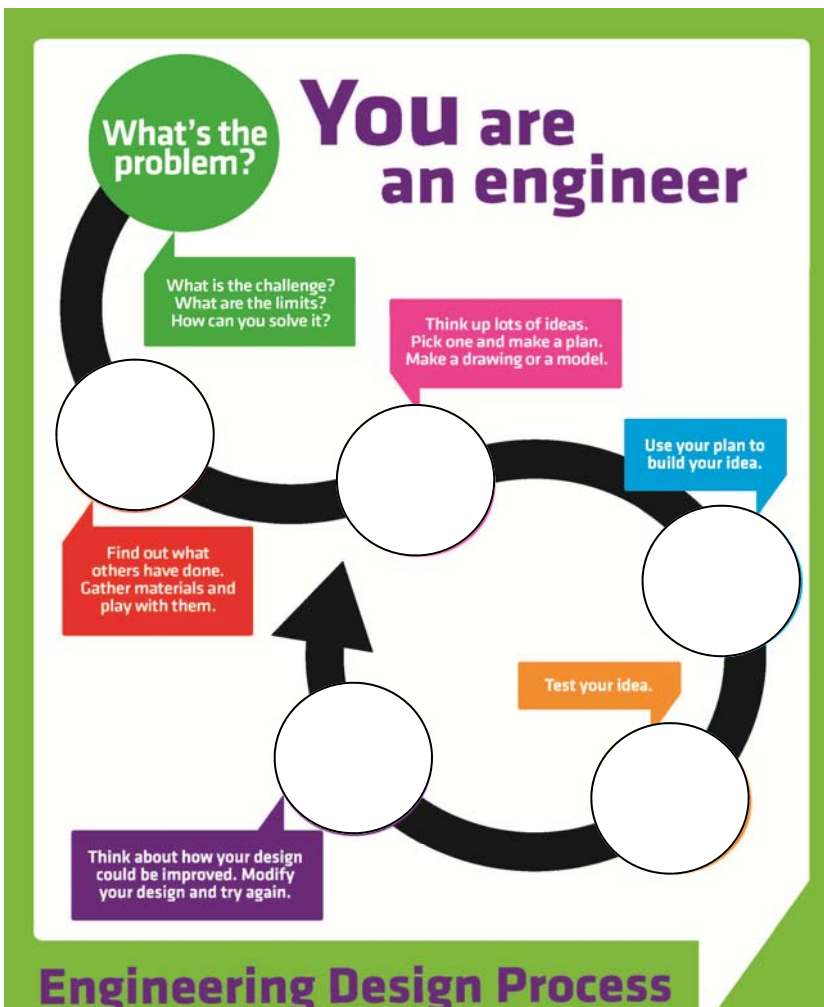
Are you interested in figuring out how things work?

Would you like to learn about bridges, buildings, electricity, airplanes or space flight?

Want to learn about energy or how to create an electrical circuit?

Then the 4-H Engineering and Safety project is for YOU!

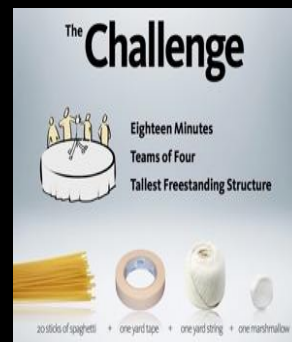
Engineers are good at solving problems. There are steps that engineers follow in order to find workable solutions to problems. Let’s learn about these important steps! First, using a dictionary or the internet, look up each of the words in the “Words to Know” section. Next, look at the chart below. Beginning with the “What’s the problem?” circle, read each of the five steps contained in the image above. Which of the words in the “Words to Know” box best describe what is going on in each step. Write the appropriate word in the circles. Not all the words in the “Words to Know” box will be used.



Words to Know . . .

Engineer	Investigate	Prototype
Design	Test	Build
Plan	Redesign	
Create	Brainstorm	

Let’s Build Something!



Teams must build the tallest free-standing structure out of 20 sticks of spaghetti, one yard of tape, one yard of string and one marshmallow. The marshmallow needs to be on top.

Can you do it?

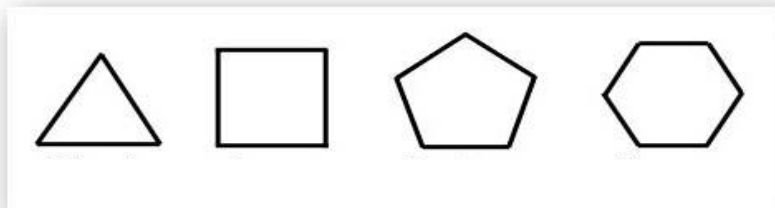
Digging Deeper . . .



Using Basic Shapes to Design and Build

When people build things, they use many different shapes, because every shape has special characteristics that are best suited for a particular purpose. For example, a wheel on a car and a Ferris wheel both use circles, because a circle turns nicely.

Can you name the following shapes?



Which shape would be the strongest to build structures with?

Can you name any buildings that have been made with this shape?

Build Something!

Use Legos, K'nex or any building toys you have to design and build a structure. Bring what you make to your 4-H club meeting and show it for a demonstration.

Career Exploration

Name a career that would involve building things.

What do people with this job actually do?

What skills are required?

What type of training or education is required?

How much money does a person with this job make?

Another idea you may want to try:

Host a "Take Apart Party"

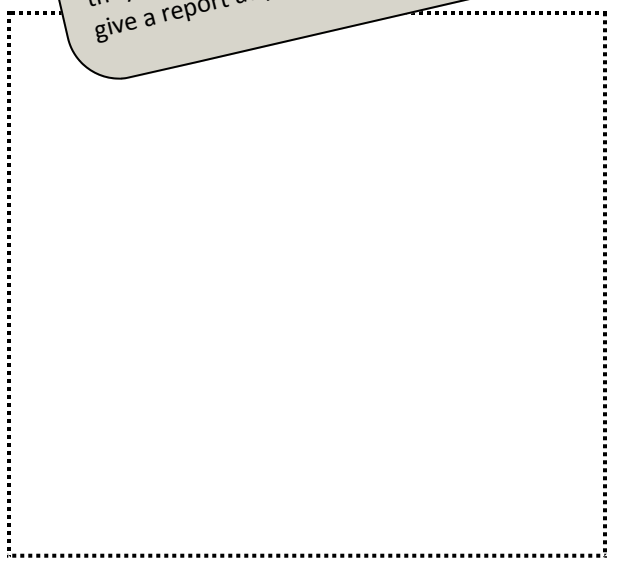
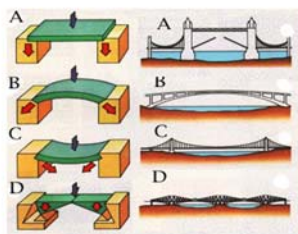
(With your parent's permission!) Invite several friends to bring broken appliances that you can all take apart and investigate how they work. Write a report on what you found or give a report at your 4-H club meeting.

Bridge Basics

Draw a bridge from one you've seen in your neighborhood or online. Can you identify the bridge design (beam, arch, suspension or cantilever)?

Basic Bridge Types

- Beam Type Bridges
- Arch Bridges
- Suspension Bridges
- Cantilever Bridges

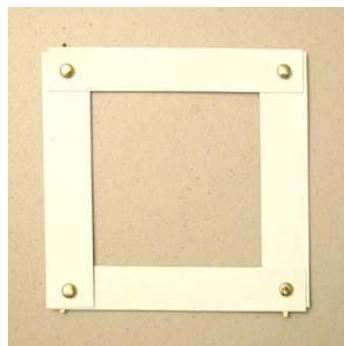
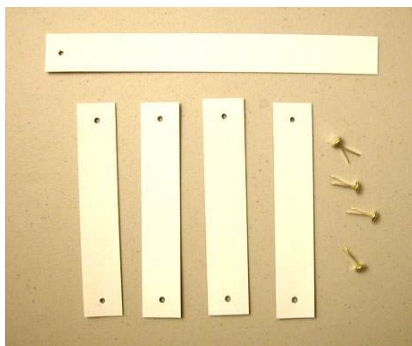


Digging Deeper . . .

Using Basic Shapes to Build Structures

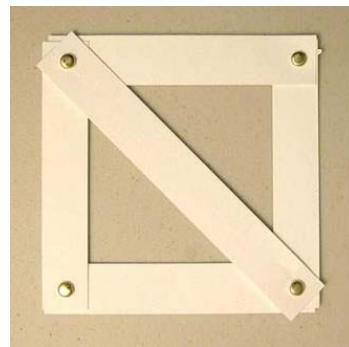
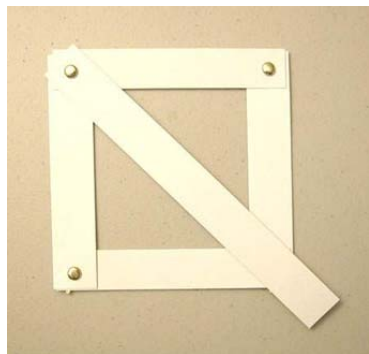
You can show how to make a stronger square, using poster board and paper fasteners.

1. First, cut four pieces of poster board, $5\frac{1}{2}$ " long and 1" wide. Cut another piece 10" long and 1" wide.
2. Carefully make holes in the ends of each short piece, centered, and $\frac{1}{2}$ " from the ends. Make just **one** hole in **one** end of the long piece. Make the holes just big enough to allow the paper fasteners to fit.
3. Next, use the paper fasteners and four of the five pieces to make a square as shown.



Hold two of the opposite (diagonal) corners and move them back and forth to see how flexible and unsupported this square is.

Now we want to make the square strong by using triangles. Remove one of the fasteners and add the fifth long piece as shown below, reconnecting the corners. Make a hole in the other corner and reconnect with the fastener. You can cut off the long piece as shown to make it neater.



Right away you can see that the square is much stronger, and you can no longer move it as before (unless you bend the paper). This idea of making weak squares much stronger is used in engineering and construction all the time.

If you remember to try to use triangles in your designs, then your designs will be strong. Without triangles, a design will be much weaker, or sometimes even impossible. One day you may be a designer or engineer and create things for other people to use.

Have fun, and may you create stronger and more successful designs in the future!