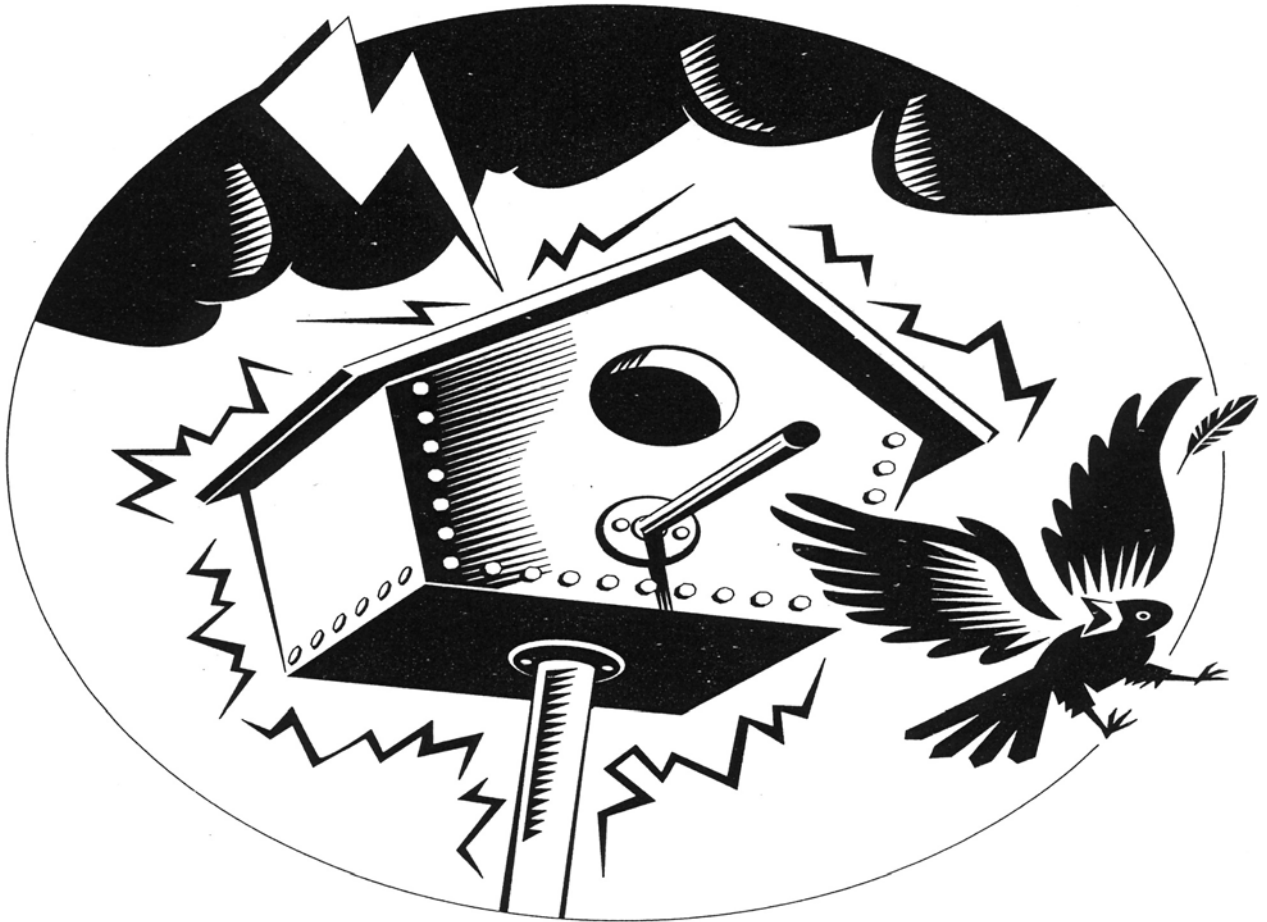


Which Material Would You Choose?



Students experiment with properties of different materials to determine which are suitable for specific products.

- A 2 pound weight (canned goods work well)
- Length of string (4 feet or more)

Grade level

Grades 4-8

Materials

- Pieces of aluminum, plastic (or plexiglass), and wood that are the same size (approximately 2' long, 1" wide and 1/8" thick)
- Serving spoons of metal, plastic and wood
- Two stacks of textbooks (each about 6" high) Hot plate and saucepan filled with hot water





Discussion

When engineers use various materials in an engineering design, they must know the properties of those materials. How strong is a specific material? Is it flexible or stiff? Does it conduct heat or electricity well? How heavy is it? Is it clear or transparent? Is it magnetic? A good engineer always gathers information, or data, before making a decision.

Activity

Students will measure the strength, heat transfer and optical properties of the aluminum, plastic and wood. Then they will choose the most appropriate materials for several products.



1. Ask students which materials (aluminum, wood or plastic) they would choose if they were the engineers responsible for designing these common household items: pots and pans; a birdhouse; container for soda pop. Write down the answers.

2. Starting with the aluminum, place each end of the aluminum strip on a stack of books. Make sure the strip is level. Place the weight in the center. Place a string stretched tight alongside the strip and measure the deflection (the bend) of the material where the weight is. Repeat the experiment for the plastic and wood. What are the students' conclusions about the strength and stiffness of each material?

3. Boil a pan of water on a hot plate. Use the various spoons to stir the water. Students should note how long it takes the handle of each spoon to become hot. Which material is a good conductor of heat? Which does not conduct heat very well? (It is called a thermal insulator.)

4. Look through the pieces of aluminum, plastic and wood. If you can see clearly, then the material is transparent. If you can see through the material somewhat but everything appears hazy, then it is translucent. If no light comes through the material at all then it is opaque.

5. Now go back and look at the products in step one and consider the engineering design problems again. See how much easier it is to choose the right material for the design if you have all the data!? Discuss the students' choices.

Aluminum is often used for pots and pans because it is a good conductor of heat. This is an excellent material for cooking your meal quickly and uniformly. However, you will need to use a potholder unless the handle of the pot has been made of a thermal insulating material, like wood or plastic. Why are some aluminum pans coated with other materials, like Teflon? Birdhouses are typically made of wood or plastic. Metal is not a good choice since it heats up in the summer and chills in the winter. Also, metal can conduct electricity which might not be too safe for birds in a thunderstorm. Would you rather buy a birdhouse made of wood or plastic? Why? Soda pop used to be sold only in glass bottles. Now you can buy it in 2-liter plastic bottles or aluminum cans. Wood isn't a good choice for many reasons, including the obvious reason that pop would soon lose its fizz as carbonation escaped through the porous wood. What other reasons are there for not choosing wood? Why isn't soda pop sold in glass bottles anymore?

This activity provided by the engineers at Phillips Petroleum Company.

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